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ABSTRACT

This teacher's guide contains energy education activities for the classroom. Activities are arranged by grade level (primary, intermediate, junior high, and high school). The book is designed so that pages may be easily removed for duplication. An introduction and usage instructions are provided along with a section of charts. (BE)

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ENERGY CONSERVATION WORKSHOP

CURRICULUM

NOVEMBER 1978

SE 031 430

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FOREWORD

The Illinois Office of Education is pleased to provide these materials developed for the Energy Conservation Workshops, which were sponsored by the Illinois Office of Education and held throughout the State in March and April, 1978. The materials presented in this publication are entitled, "Energy Conservation Workshop - Curriculum."

This series of seven workshops was designed to include the areas of Facilities Management and Operations, Transportation, Life Cycle Costing and Curriculum. Energy Education Programs was contracted to conduct the Curriculum portion of these workshops. The materials contained in this publication were developed by Mr. Dennis Gaul and Mr. Michael Kynell of Energy Education Programs, for use and dissemination in these workshops. In order to meet the anticipated demands, the Illinois Office of Education has reprinted these materials for distribution to all school facilities.

The Illinois Office of Education expresses their appreciation to Energy Education Programs for their permission to reprint these materials.

Joseph M. Cronin,
State Superintendent of Education

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What is Energy Education?

The Illinois Office of Education sponsored a series of seven Energy Conservation Workshops which were held throughout the state during March and April 1978. Mr. Dennis Gaul and Mr. Mike Kynell of Energy Education Programs were contracted by the Illinois Office of Education to conduct the Curriculum portion of the Workshops. The following is a summarization of some of the ideas and concepts presented by Mr. Dennis Gaul and Mr. Mike Kynell at these Workshops.

What is Energy Education?

Energy education is a confrontation between the concept of our present life style and the concept of what it costs to produce and maintain that life style.

Energy education is reality education--reality being defined as that which truly exists here and now.

Energy education is a study of futuristics. The future that all of us must be willing to live in and accept is the one that we are beginning to create right now by the decisions that we are making as citizens in an energy intensive society.

Energy education is the challenge of today and tomorrow. Can you as an educator help our society make some very difficult choices for the future? Can you explain how we as a country became ensnared in the energy merry-go-round? Can you explain to your classes where energy comes from, what the basic sources of energy are today, how energy is converted from one form to another, or which forms of energy are the most used in our society?

If energy education sounds to you like it is a job for more than one person, you are right. You need help. You have to go out in your own district and recruit help. You have to convince others that tomorrow may hold some unpleasant surprises for us all unless we all work together to find meaningful and workable solutions to our problems.

Your First Job?

The first obstacle you have to deal with is yourself. You know and I know that it is a lot easier as a teacher not to deal with anything controversial in the classroom. By talking about the energy situation you are going to get involved in the problems that confront us all on a worldwide basis. You will have to fight to get curricula rewritten so there is time allotted for the subject of energy. You will have to convince teachers other than those involved in environmental education or science that they must become involved in dealing with the topic of energy in their classroom. Most important of all, you must get everyone involved in or concerned with education to begin examining their own personal attitudes and life styles as they relate to energy if you are going to succeed in providing a program that has the necessary impact. This includes the board of education, administrators, teachers, coaches, transportation people, custodians, cooks, students, parents, business and industry people, governmental people, and every citizen in general. You may ask yourself, "Why should I get involved?", or "Where am I going to find all the information that I need?"

Why Me?

In answer to the first question, you should get involved because you are in a position to affect great changes in the next few years. You hold in your hands the key to a future which we can all accept if we begin immediately to examine the way we live, why we live that way, and how we can do things differently. As a professional educator you can be one of the most important people in this country, if you choose to be.

Where Do I Start?

In answer to the second question, the information that you need to do an effective job in the classroom is available from hundreds of sources at anywhere from no cost to high cost. If you want complete surveys of total energy consumption patterns you will have to pay for them. If you want materials that deal with specific energy programs to hand out to your students, they generally are available from either the federal government or private utilities at no cost. You will find that some of the things you receive are totally worthless while others are priceless. Having taught the subject of energy in our classrooms for the past five years, we have found ourselves throwing an awful lot of material in the circular file. By the way, don't expect any of the information you receive to fit exactly into the program that you are going to develop. You will have to razor, rip apart, reorganize, and reproduce the materials you want your students to use.

Can I Get Help?

Let's assume that you undertake the teaching of energy in your classroom and you touch on the topic "The Quality of Life," but don't feel very qualified to deal with the subject. Why not make your classroom an open forum to members of your local and regional community. Ask people from local industries to talk to your students about life styles. Ask religious leaders to talk about moral values and consumption habits. Ask government leaders to talk about regulations concerning personal liberties and personal choices. Ask representatives from the environmental movement to explain ecosystems and socio-economic symbiotic relationships as they affect life styles. You might even find members of your own staff who have special areas of strength and would be willing to become involved in your program.

Should I Be Controversial?

Don't be afraid to introduce controversy into your classroom. Don't be afraid to play the role of devil's advocate to provoke arguments concerning critical points in the area of energy. Don't assume that you are the ultimate source of all pertinent information. Be willing to allow students to challenge your information base and authority. If you have been the type of teacher who has not practiced these techniques on a regular basis you may find yourself struggling to allow your classroom to become a forum of discussion and debate. Once you have overcome the initial shock that you might not know

everything you will find yourself becoming excited because you are getting involved with your students.

Introduce All Viewpoints!

In teaching energy, you cannot restrict yourself to only one point of view such as environmental issues, conservation, or the production of energy because each is intricately interwoven with the others. It is recommended that any energy curriculum or course include as a minimum, utilization, production, distribution, conservation, and environmental concerns. To this could be added numerous other topics such as government regulations, socio-economic factors, and national and international politics. When you begin to develop resources to deal with the five areas, you will have to work at overcoming your own prejudices. Don't exclude any of the viable, workable forms of energy from discussion because of your own biases. Be willing to deal with those topics you already have strong opinions on with an air of objectivity and true inquiry. Your students will detect your own prejudices soon enough without you beating them over the head with your own judgements thereby stifling any desire to be innovative or creative.

The remainder of this publication contains the energy education activities that have been developed for use in the classroom by Energy Education Programs. The activities are subdivided as to grade levels. This book was designed so that the pages may be easily removed for duplicating purposes.

Primary Energy Education Activities

Primary Energy Education Activities

In the primary grades the focus of the energy unit should be on the home, the school and the child's own personal use (or misuse) of energy. These children will soon become aware that energy is needed to heat or cool their homes, operate their light and appliances, and move them from place to place. As this awareness heightens, the children can be exposed to the sources of energy which provide them with so many conveniences. The natural follow-up then, is what they can do on their own to save energy.

The materials included in this section are designed to be used as is or can be modified by the teacher. The activities listed can be easily carried out even if the teacher feels unsure in the area of energy. These materials represent only a suggestion for a place to start.

Activities - Primary 1-3

1. Have the students construct collages showing energy users. Restrict each collage to a particular topic such as electrical appliances, transportation, the home, or recreation.
2. Take the students on tour of the school building. Help them discover where the heat comes from, what the fuel is, and how the heat is moved around the building.
3. Have the students guess how most of the heat in a building is lost (through windows, walls, roofs, doors, etc.).

During the winter months, have the students place their hands on the glass window, the outside walls, and on the inside walls. Which is coldest? How can the heat loss be stopped?

4. Have the students do a light bulb survey of their own home and determine what areas use the greatest wattage.

5. Have the students do an energy use survey of their own home, checking things like daily or weekly consumption of energy (gas, oil, electricity). Provide them with the needed forms to do this.

6. Sponsor a "Least Energy User Contest" with the winner being the one who can reduce his or her family energy bills the most over a two month period of time.

7. Have students construct a draft meter by using a piece of lightweight paper or thread that is attached to the end of a pencil. By holding this device near windows or doors drafts can be easily located.

8. Have students cover three shoe boxes with different types of material (white paper, black paper, and aluminum foil). Place a thermometer inside each box and check the temperature of each after they have been exposed to the sun for 15 minutes. Discuss the concept of solar heat.

9. Have students place a few sweet pea seeds into a paper cup half filled with dirt. Place the cup in a sunny spot

and water twice a week. Follow instructions on the worksheet.

WHAT IS ENERGY?

ENERGY IS THE ABILITY TO DO WORK! EVERY TIME WE DO ANY KIND OF WORK WE USE ENERGY. WHAT KINDS OF WORK DO WE DO EVERY DAY?

1. _____ 2. _____

3. _____ 4. _____

WHAT ABOUT MACHINES?

WHEN WE USE A MACHINE TO HELP US DO WORK A LOT OF ENERGY IS USED. WHAT KINDS OF MACHINES DO WE USE TO HELP US?

1. _____ 2. _____

3. _____ 4. _____

WHAT ARE SOME OTHER WAYS WE USE ENERGY?

WE USE ENERGY IN MANY DIFFERENT WAYS.

1. WE USE ENERGY TO HEAT OUR HOMES WHEN IT IS COLD OUTSIDE.
2. WE USE ENERGY TO COOL OUR HOMES WHEN IT IS HOT OUTSIDE.
3. WE USE ENERGY TO MAKE MACHINES AND TO MAKE ALL KINDS OF THINGS.
4. WE USE ENERGY TO LIGHT UP OUR HOMES AND SCHOOLS WHEN IT IS DARK OUTSIDE.
5. WE USE ENERGY TO RUN OUR CARS AND TRUCKS SO WE CAN MOVE PEOPLE AND THINGS AROUND FROM PLACE TO PLACE.

DRAW A PICTURE OF ONE WAY THAT WE USE ENERGY.

WHAT WAY DO YOU THINK WE USE THE MOST ENERGY IN OUR COUNTRY?

WHERE DO WE GET ENERGY?

ENERGY IS ALL AROUND US.

1. WE CAN GET ENERGY FROM EATING PLANTS SUCH AS VEGETABLES AND FRUITS.
2. WE GET ENERGY FROM EATING MEAT OF ANIMALS SUCH AS CHICKENS, COWS, AND PIGS.
3. WE GET ENERGY FROM THE EARTH SUCH AS OIL, COAL, NATURAL GAS, AND URANIUM.
4. THE SUN GIVES ENERGY SO THAT PLANTS, ANIMALS AND PEOPLE CAN LIVE AND GROW.
5. THE EARTH HAS MANY SPECIAL SOURCES OF ENERGY SUCH AS THE WIND, THE HEAT FROM INSIDE THE EARTH, AND THE FORCE OF FALLING OR MOVING WATER.

SOME OF OUR SOURCES OF ENERGY ARE EASY TO USE AND OTHERS ARE VERY HARD TO USE. WHICH SOURCES OF ENERGY DO YOU USE EVERY DAY?

1. _____ 2. _____

3. _____ 4. _____

WHICH SOURCES OF ENERGY ARE EASY FOR YOU TO GET?

1. _____ 2. _____

WHICH KINDS OF ENERGY ARE VERY HARD FOR YOU TO GET?

1. _____ 2. _____

SOME SOURCES OF ENERGY CAN BE USED JUST AS WE FIND THEM. SOME SOURCES OF ENERGY HAVE TO BE CHANGED SO WE CAN USE THEM TO HELP US. WHAT KINDS OF ENERGY CAN WE USE WITHOUT CHANGING THEM?

_____

_____

<u>SOURCES OF ENERGY</u>

MOST OF THE ENERGY WE USE IN OUR COUNTRY COMES FROM BURNING <u>FOSSIL FUELS</u>. WE KNOW THEM BETTER AS <u>COAL</u>, <u>OIL</u>, <u>GASOLINE</u>, AND <u>NATURAL GAS</u>. THESE ARE CALLED FOSSIL FUELS BECAUSE THEY ARE MADE UP OF THE BONES OF THINGS (FOSSILS) THAT LIVED ON THE EARTH A LONG, LONG TIME AGO.

COAL IS MADE OF THE FOSSILS OF DEAD TREES AND PLANTS THAT GREW ALL OVER OUR COUNTRY. WHEN THE TREES AND PLANTS DIED THEY BECAME BURIED UNDER THE GROUND IN THICK LAYERS. AFTER A LONG, LONG TIME THOSE PLANTS WERE CHANGED INTO COAL.

WORD SCRAMBLE:

ISFOSL _____

EIOAGSLN _____

IOL _____

LOCA _____

ENBOS _____

WHAT DO WE GET WHEN WE BURN COAL?

1. _____ 2. _____

WHAT MUST WE DO TO THE SURFACE OF THE GROUND TO GET THE COAL OUT SO WE CAN USE IT?

_____

_____

WHAT SHOULD WE DO WHEN WE HAVE TAKEN ALL THE COAL OUT OF THE GROUND?

_____

SOURCES OF ENERGY

SOME OF THE ENERGY WE USE COMES FROM THINGS THAT WE KEEP GETTING MORE OF, SUCH AS PLANTS, ANIMALS, AND THE SUN. MOST OF THE ENERGY WE USE TO DRIVE OUR CARS OR HEAT OUR HOUSES COMES FROM SOURCES THAT WE WILL NEVER HAVE MORE OF, SUCH AS COAL, OIL, OR NATURAL GAS. WE HAVE USED SO MUCH OF SOME OF OUR ENERGY SOURCES THAT WE ARE BEGINNING TO RUN OUT OF THEM. WHAT SOURCES OF ENERGY ARE WE RUNNING OUT OF?

_____

_____

OIL AND NATURAL GAS ARE FOUND UNDER THE GROUND IN POCKETS OR POOLS THAT HAVE BEEN FORMED A LONG, LONG TIME AGO. WE DRILL HOLES IN THE GROUND AND PUMP OIL AND GAS OUT SO WE CAN USE THEM. BEFORE WE CAN USE OIL, IT HAS TO BE CHANGED INTO GASOLINE OR OTHER THINGS. NATURAL GAS CAN BE USED IN FURNANCES AND HEATERS TO GIVE US HEAT WITHOUT CHANGING IT FIRST.

COAL IS FOUND UNDER THE GROUND IN THICK LAYERS CALLED SEAMS. WE HAVE TO DIG INTO THE SURFACE OF THE EARTH SO WE CAN GET THE COAL OUT. WE USE COAL TO MAKE THINGS FOR US AND TO GIVE US HEAT FOR HOMES AND FACTORIES WHERE THINGS ARE MADE. COAL CAN BE USED WITHOUT CHANGING IT TO GIVE US HEAT.

SOURCES OF ENERGY

DRAW A PICTURE OF THREE SOURCES OF ENERGY THAT ARE FOUND ABOVE THE GROUND.

WHAT ARE THREE SOURCES OF ENERGY THAT WE FIND BELOW THE GROUND?

1. _____ 2. _____

3. _____

WHERE DO WE GET THE ENERGY TO KEEP OUR BODIES RUNNING?

_____

DRAW A PICTURE OF YOUR FAVORITE SOURCE OF ENERGY FOR YOUR BODY.

WHERE DOES IT COME FROM?

_____

HOW CAN YOU GET MORE OF YOUR FAVORITE ENERGY SOURCE?

_____

_____

DOES THE SUN HAVE ANYTHING TO DO WITH PRODUCING ENERGY FOR OUR BODIES?

_____ WHAT? _____

_____

SOURCES OF ENERGY

PLANT SOME SWEET PEA SEEDS IN A PAPER CUP FILLED WITH DIRT. PLACE THE CUP IN A SUNNY WINDOW AND WATER SEEDS TWICE A WEEK. WATCH WHAT HAPPENS. DRAW YOUR NEW PLANT.

WHAT WOULD HAPPEN IF YOU PUT THE PLANT IN THE DARK CLOSET?

_____

WHY WOULD THAT HAPPEN?

_____

_____

WHAT WOULD HAPPEN IF YOU PULLED THE PLANT OUT OF THE CUP?

_____

WHY WOULD THAT HAPPEN?

_____

_____

WHERE DOES A PLANT GET ITS ENERGY?

_____

_____

HOW DO WE MOVE PEOPLE FROM PLACE TO PLACE?

1. _____ 2. _____
3. _____ 4. _____
5. _____ 6. _____

WHICH ONES DO MOST PEOPLE USE OR OWN?

1. _____ 2. _____

WHICH ONES DO WE NEED THE MOST?

1. _____ 2. _____

CAN WE GET ALONG WITHOUT THEM?

_____

WHICH KIND OF TRANSPORTATION USES THE MOST ENERGY?

_____

WHAT SOURCE OF ENERGY DO WE USE MOST IN TRANSPORTING PEOPLE AND THINGS?

_____

WHICH KIND OF TRANSPORTATION USES THE SMALLEST AMOUNT OF ENERGY TO MOVE THINGS FROM PLACE TO PLACE?

_____

HOW CAN WE HELP SAVE ENERGY WE USE IN TRANSPORTATION?

_____

_____

WHAT KIND OF ENERGY USER ARE YOU?
HOW MANY OF EACH DO YOU HAVE?

IF YOU ARE NOT SURE, HAVE MOM OR DAD HELP YOU.
MAKE SURE YOU LOOK IN THE BASEMENT, GARAGE, AND OUTSIDE.

LIGHT BULBS

_____ 25 WATTS
_____ 40 WATTS
_____ 60 WATTS
_____ 75 WATTS
_____ 100 WATTS
_____ 150 WATTS
_____ 200 WATTS
_____ 250 WATTS
_____ 300 WATTS
_____ ___ WATTS
_____ ___ WATTS

AFTER YOU FINISH LOOKING FOR LIGHT BULBS GO BACK OVER THE LIST AND NAME ANY THAT YOU DO NOT NEED.

_____ _____
_____ _____
_____ _____
_____ _____

WHAT KIND OF ENERGY USER ARE YOU?
HOW MANY OF THEM DO YOU HAVE?

IF YOU ARE NOT SURE, HAVE MOM OR DAD HELP YOU.

IF YOU HAVE THE ENERGY USER CIRCLE THE "YES".

IF YOU DO NOT HAVE THE ENERGY USER CIRCLE THE "NO".

MAJOR ELECTRICAL APPLIANCES

YES NO CLOTHES DRYER
YES NO CLOTHES WASHER
YES NO DISHWASHER
YES NO FOOD FREEZER
YES NO FOOD WASTE DISPOSAL
YES NO ICE CUBE MAKER
YES NO RANGE (STOVE)
YES NO REFRIGERATOR
YES NO TRASH COMPACTOR
YES NO WATER HEATER
YES NO _____
YES NO _____

ELECTRICAL HOUSEKEEPING APPLIANCES

YES NO FLOOR POLISHER
YES NO FLOOR SCRUBBER
YES NO IRON
YES NO RUG SHAMPOOER
YES NO VACUUM CLEANER
YES NO WATER SOFTENER
YES NO _____
YES NO _____
YES NO _____
YES NO _____

AFTER YOU FINISH LOOKING FOR ENERGY USERS GO BACK OVER THE LIST AND UNDERLINE ANY THAT YOU THINK YOU COULD LIVE WITHOUT.

HOW CAN YOU SAVE OR USE LESS ENERGY AROUND YOUR HOME?

1. DO NOT LEAVE OUTSIDE DOORS OPEN WHEN YOU LEAVE OR COME IN THE HOUSE.
2. MAKE SURE THAT WINDOWS ARE CLOSED TIGHT WHEN THE HEAT IS ON (OR WHEN THE AIR CONDITIONER IS RUNNING.)
3. WEAR SWEATERS AND OTHER WARM CLOTHES IN THE HOUSE, DURING THE WINTER.
4. WHEN YOU GO OUT TO PLAY, DO NOT KEEP COMING IN TO GET WARM OR GO TO THE BATHROOM.
5. DO NOT PUT MORE WATER INTO THE BATHTUB THAN YOU REALLY NEED.
6. DO NOT JUST STAND IN THE SHOWER BECAUSE IT FEELS GOOD.
7. DO NOT LOOK IN THE OVEN TO SEE WHAT IS THERE. ASK MOM.
8. DO NOT LOOK IN PANS THAT ARE COVERED. ASK MOM WHAT SHE IS COOKING.
9. LEAVE THE REFRIGERATOR CLOSED UNLESS YOU NEED TO GET SOMETHING.
10. MAKE SURE YOUR CLOTHES ARE DIRTY BEFORE YOU PUT THEM IN THE LAUNDRY.
11. HELP MOM HANG CLOTHES OUTSIDE RATHER THAN USING THE DRYER.
12. TURN THE LIGHTS OFF WHEN YOU ARE NOT IN A ROOM.
13. WHEN YOU ARE HUNGRY EAT SOMETHING THAT DOES NOT NEED COOKING.
14. TAKE YOUR LUNCH TO SCHOOL IN A PAPER BAG. DO NOT THROW THE BAG AWAY, TAKE IT HOME TO USE AGAIN.

15. WHEN YOU WASH YOUR HANDS, PUT SOME WATER IN THE SINK; DO NOT JUST LET IT RUN.
16. WHEN YOU BRUSH YOUR TEETH, TURN THE WATER OFF WHILE YOU ARE BRUSHING.
17. USE A REGULAR BRUSH RATHER THAN AN ELECTRIC TOOTHBRUSH.
18. PUT AN EXTRA BLANKET ON YOUR BED SO THE HEAT CAN BE TURNED DOWN.
19. TURN THE T.V. OFF WHEN YOU ARE DONE WATCHING IT.
20. DO NOT LEAVE ALL THE LIGHTS IN THE ROOM ON WHEN YOU ARE WATCHING T.V.
21. PLAY WITH GAMES AND TOYS THAT DO NOT NEED ELECTRICITY. READ A BOOK.

Intermediate Energy Education Activities

In the intermediate grades the focus of the energy unit should shift from personal energy habits to community and societal attitudes and lifestyles. As the students examine society's energy usage some natural questions should arise concerning sources of energy. They can then be reintroduced to the fossil fuels, nuclear power, and various alternatives for the future. Environmental issues can also be dealt with as they relate to energy production and use.

Some basic concepts that students should be exposed to at this level are:

Our society is . . . . . .

Urban - Most of the people in the United States live in or around large cities.

Industrialized - Most of the people in the United States work for factories or businesses that manufacture products.

Specialized - Most of the people in the United States do not provide all or even a majority of the things they consume. We need each other.

Mobile - Most of the families in the United States own one or more vehicles which they use to travel to jobs, schools, or recreation.

Technological - We have come to depend on machines for almost everything that used to be done by muscle power. Using machines causes us to use more energy, energy to create and build the machines and energy to run the machines.

Energy Intensive - Our way of life in the 20th century United States dictates that we consume vast quantities of energy.

Activities - Intermediate 4-6

1. Have the students list all the different methods of energy production that they can. Be sure they include the sun, winds, tides, natural gas, oil, gasoline, nuclear fission (atomic), hydropower, geothermal, biomass, and fusion. If they can't list all of these, fill in the gaps for them. Have them vote for the one that provides the most energy in our country today (natural gas). If they don't know what some of the above list are, assign students to research the unknown types and report back to the class in two days on what they have learned.

2. Assign groups of students to work on each energy source and list as many good things about each as they can find. After they have done this, have them list as many bad things about each as they can.

3. Obtain maps showing geographical locations of the major energy resources, and have the students catalog the states and/or nations which have the most resources. Then have them compare the states and/or nations with the greatest populations and rates of energy consumption.

4. Obtain pictures of oil or coal barges, supertankers, oil and gas pipelines, electrical transmission lines, and unitrains. Talk about the difficulties and costs of moving energy.

5. Have students institute an "Ernie Energy Award" in their school for those who waste the least amount of energy by turning off lights, etc.

6. Have the students do an energy use survey of their own home, checking things like daily or weekly consumption of energy (gas, oil, electricity). Provide them with the needed forms to do this.

7. Sponsor a "Least Energy Use Contest" with the winner being the one who can reduce his or her family energy bills the most over a two-month period of time.

8. Have students keep an energy log in which they note all the situations in which they consume energy and every time they conserve energy by using an alternative source (bicycling rather than riding in a car). Devise a system which awards points for energy saved and deducts points

for energy consumed needlessly, with the winners receiving some kind of recognition.

9. Paint three cans of the same size with a flat black paint. Fill one can with water at room temperature, one with sand at room temperature, and leave one with air in it. Cover the cans and put a thermometer in each container and place in a sunny spot. Record the temperature of the cans every 15 minutes until noon. Take the cans out of the sun and set them in the shade again, recording the temperature every 15 minutes. Which container warms up the fastest? Which container warms up the slowest? Which container cools off the fastest? Which container cools off the slowest?

10. Vocabulary words for this level

BTU	hydrogen	hydrocarbon
watt	kilowatt	natural gas
energy	megawatt	fossil fuel
machine	refinery	efficiency
uranium	generator	solar energy
methane	cubic foot	petrochemical
nuclear	geothermal	photosynthesis
propane	conversion	coal gasification
turbine	electricity	hydropower energy

11. Discuss with students the relationship between lifestyles and energy consumption. Be sure to include concepts on migration patterns, locations of major urban areas,

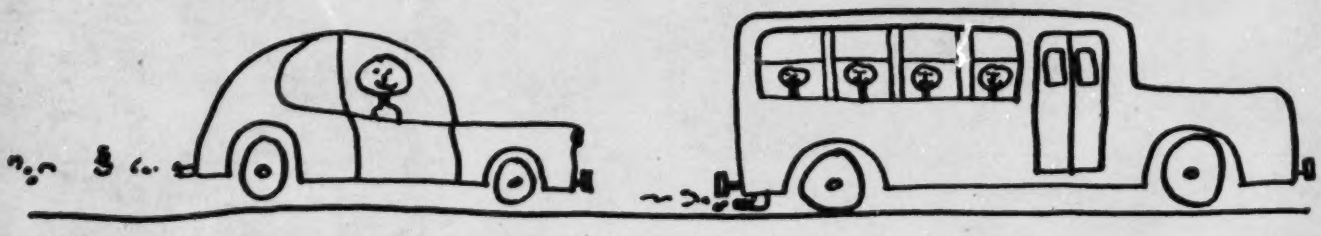
changing consumption patterns, public versus private transportation, changes in technology and single family dwelling units.

HOW DO WE MEASURE ENERGY?

ENERGY IS MEASURED BY USING THE TERM BRITISH THERMAL UNIT. A BRITISH THERMAL UNIT OR BTU IS ABOUT THE SAME AMOUNT OF ENERGY THAT WE GET BY BURNING A WOODEN MATCH.

WE USE BTU'S TO MEASURE THE AMOUNT OF ENERGY THAT CAN BE GOTTEN OUT OF LOTS OF DIFFERENT THINGS.
A LUMP OF ILLINOIS COAL WEIGHING ONE POUND CONTAINS ABOUT 12,000 BTU'S OF ENERGY. THAT IS A LOT OF MATCHES!

WHEN WE TALK ABOUT USING, OR CONSUMING ENERGY, WE MEASURE THE AMOUNT WITH BTU'S. TO DRIVE THE AVERAGE CAR JUST ONE MILE CONSUMES THOUSANDS OF BTU'S.



A SCHOOL BUS CONSUMES A LOT MORE BTU'S OF ENERGY THAN A CAR DOES BUT A SCHOOL BUS CARRIES 50 OR 60 PEOPLE. WE CALL A SCHOOL BUS ENERGY EFFICIENT (EE-FISH-UNT). MAYBE WE SHOULD ALL RIDE ON SCHOOL BUSES RATHER THAN RIDING IN CARS.

SOURCES OF ENERGY

HOW CAN WE USE THE ENERGY FROM A RIVER?

_____

_____

DRAW A PICTURE THAT SHOWS HOW YOU WOULD USE THE POWER IN A RIVER.

WHAT HAPPENS TO THE RIVER IN THE COLD WINTER?

_____

_____

WHY DO WE SOMETIMES DAM UP A RIVER?

_____

_____

CAN WE DO ANYTHING WITH ALL THE WATER THAT IS TRAPPED BEHIND THE DAM?

_____

_____

WHAT ELSE? _____

_____

MANY YEARS AGO PEOPLE USED THE ENERGY OF THE WIND TO DO WORK.

DRAW A PICTURE OF HOW WE CAN USE THE POWER OF THE WIND.

WHAT ARE TWO OTHER THINGS THE WIND CAN DO FOR US?

1. _____

2. _____

DOES THE WIND ALWAYS BLOW THE SAME?

_____

WHAT WOULD HAPPEN IF THE WIND WOULDN'T BLOW AT ALL?

_____

_____

_____

_____

SOURCES OF ENERGY

OIL AND NATURAL GAS GIVE US THE ENERGY WE USE TO DRIVE OUR CARS AND TRUCKS AND TO HEAT OUR HOMES.

WHAT MUST WE DO TO GET OIL AND NATURAL GAS OUT OF THE GROUND?

_____

_____

OIL AND NATURAL GAS ARE FOSSIL FUELS THAT ARE MADE UP OF THE REMAINS OF TINY SEA ANIMALS THAT LIVED ON EARTH A LONG TIME AGO.

WHAT DO WE DO WITH MOST OF THE OIL WE PUMP OUT OF THE GROUND?

_____

_____

OIL IS A SOURCE OF MANY THINGS OTHER THAN ENERGY. WE CAN MAKE PLASTIC FROM OIL. WE ALSO CAN MAKE NYLON FROM OIL.

WHY ARE WE RUNNING OUT OF OIL AND NATURAL GAS?

_____

_____

_____

MOST OF THE OIL WE PUMP OUT OF DEEP WELLS IS USED TO MAKE GASOLINE WHICH MAKES CARS AND TRUCKS GO WHEN WE DRIVE THEM.

WHAT KINDS OF THINGS CAN WE MAKE OUT OF OIL?

_____

_____

NATURAL GAS IS ALSO PUMPED OUT OF THE GROUND. WE USE NATURAL GAS TO HEAT OUR HOMES, SCHOOLS, AND FACTORIES.

DRAW ONE THING WE CAN MAKE FROM OIL.

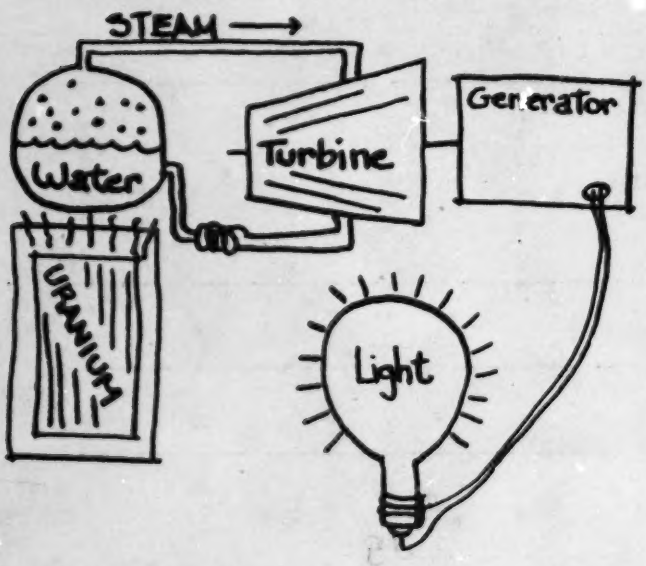
SOURCES OF ENERGY

URANIUM IS AN IMPORTANT SOURCE OF ENERGY TODAY. URANIUM IS DUG OUT OF THE GROUND JUST LIKE WE DIG COAL OUT OF THE GROUND.

WHEN WE GET ENOUGH OF THE RIGHT KIND OF URANIUM CLOSE TOGETHER WE CAN MAKE A LOT OF HEAT. WE CAN USE THE HEAT TO MAKE WATER BOIL AND FROM BOILING WATER WE CAN MAKE ELECTRICITY.

WE CAN'T MAKE ANYTHING ELSE OUT OF URANIUM EXCEPT HEAT.

TO MAKE ELECTRICITY WE NEED MACHINES CALLED A TURBINE AND A GENERATOR.



WHAT ARE SOME OF THE THINGS WE CAN MAKE OUT OF FOSSIL FUELS BESIDES HEAT?

_____

_____

_____

_____

WE CAN USE ANY FOSSIL FUEL TO BOIL THE WATER TO MAKE ELECTRICITY.

WE CAN USE THE FOSSIL FUELS TO MAKE OTHER THINGS BESIDES HEAT. DO YOU THINK WE SHOULD SAVE THE FOSSIL FUELS?

_____

_____

WHAT DO WE NEED TO MAKE ELECTRICITY?

1. _____
2. _____
3. _____
4. _____

WE ALSO NEED LOTS OF MONEY.

SOURCES OF ENERGY

SOME OF THE ENERGY WE USE TODAY COMES FROM A SPECIAL SOURCE CALLED URANIUM. URANIUM IS DUG OUT OF THE GROUND AND MUST BE CHANGED SO WE CAN USE IT. IF WE GET ENOUGH URANIUM WE CAN MAKE A LOT OF HEAT WHICH WE CAN USE. THE HEAT CAN BE USED TO MAKE ELECTRICITY. ELECTRICITY MAKES LIGHTS WORK AND MOTORS TURN AND PUMPS PUMP. A LOT OF THE ENERGY WE USE EVERY DAY IS IN THE FORM OF ELECTRICITY. WHAT ARE SOME OF THE WAYS WE USE ELECTRICITY?

1. _____ 2. _____

3. _____ 4. _____

5. _____ 6. _____

USING ELECTRICITY IS ONE OF THE MOST COMMON WAYS WE CONSUME ENERGY TODAY. WE CAN PRODUCE ELECTRICITY BY USING ANY ENERGY SOURCE. WE CAN PRODUCE ELECTRICITY BY USING FOSSIL FUELS SUCH AS COAL, OIL, AND NATURAL GAS. IN THE FUTURE WE MIGHT BE ABLE TO USE THE WIND, THE SUN, OR TIDE.

OF ALL THE SOURCES OF ENERGY WE USE, WE HAVE MORE COAL THAN ANYTHING ELSE. WHY DON'T WE USE MORE COAL AND SAVE OUR OIL AND GAS?

_____

_____

_____

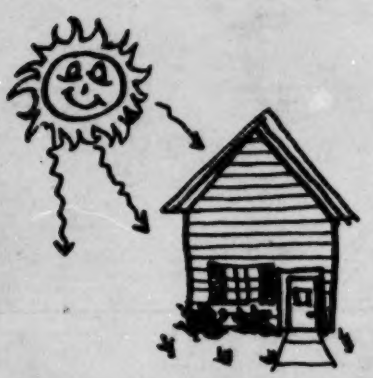
WHAT HAPPENS WHEN WE BURN COAL?

_____

_____

_____

SOURCES OF ENERGY



THE SUN CAN PROVIDE DIRECT HEAT FOR YOUR HOME IN THE WINTER EVEN IF YOU DON'T HAVE A LOT OF SPECIAL EQUIPMENT. IN THE MORNING YOU CAN OPEN THE SHADES OR CURTAINS ON WINDOWS THAT FACE THE SOUTH. THE SUN WILL HELP WARM THESE ROOMS DURING THE DAY AND SAVE ON FUEL. IN THE LATE AFTERNOON THE SHADES AND CURTAINS SHOULD BE CLOSED TO HELP KEEP THE HEAT IN THE ROOM.

DURING THE SUMMER THE SHADES OR CURTAINS ON WINDOWS FACING THE SUN SHOULD BE CLOSED DURING THE DAY TO KEEP ROOMS COOLER.

THE HEAT FROM THE SUN CAN BE USED TO DRY CLOTHES, EVEN IN THE WINTER. USING SOLAR ENERGY IN THIS WAY CAN SAVE A LOT OF GAS AND ELECTRICITY.

THE HEAT FROM THE SUN CAN ALSO HELP PUT MOISTURE IN THE AIR IN THE WINTER. THIS WILL HELP MAKE THE HOUSE FEEL MORE COMFORTABLE SO YOU NEED LESS HEAT. ALL YOU NEED IS A FLAT PAN OF WATER THAT SITS IN THE SUN.

LIST FOUR WAYS WE CAN USE THE HEAT OF THE SUN.

1. _____

   _____

2. _____

   _____

3. _____

   _____

4. _____

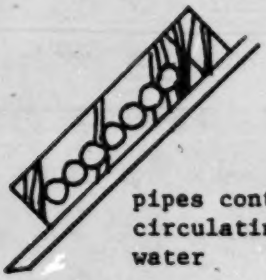
   _____

SOURCES OF ENERGY

SOLAR COLLECTOR ON ROOF OF HOUSE

solar collectors

Glass plate to keep heat from escaping on cold windy days



Cross Section

pipes containing circulating water

roof line

hot water storage in basement

IF YOU WANT TO HEAT MORE OF YOUR HOME WITH THE SUN YOU WILL HAVE TO BUY SOMETHING CALLED A SOLAR COLLECTOR. THIS WILL CAPTURE MORE OF THE SUN'S ENERGY TO HEAT EITHER AIR OR WATER THAT CAN BE SENT THROUGH THE HOUSE.

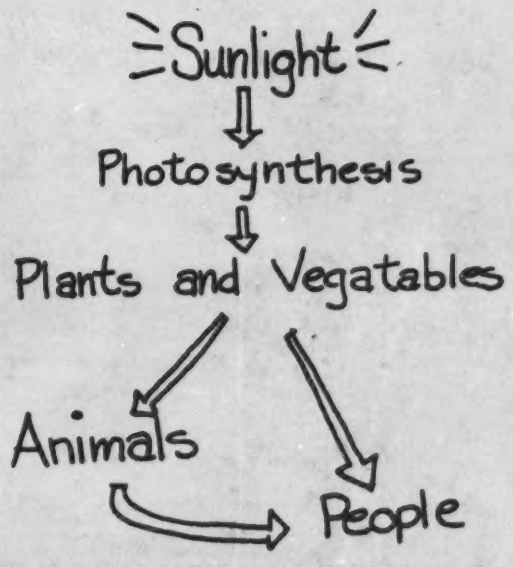
SOLAR COLLECTORS CAN BE CONNECTED TO WATER HEATERS. THE HOT WATER CAN THEN BE USED FOR BATHS, DOING DISHES, AND WASHING CLOTHES.

LIST SOME ADVANTAGES AND DISADVANTAGES OF SOLAR ENERGY.

ADVANTAGES	DISADVANTAGES
_____	_____
_____	_____
_____	_____
_____	_____

SOURCES OF ENERGY

BESIDES PROVIDING DIRECT HEAT, THE SUN ALSO PROVIDES US WITH ENERGY THROUGH A PROCESS CALLED PHOTOSYNTHESIS. WHEN THE LIGHT OF THE SUN HITS THE LEAVES OF PLANTS, THE PLANT CAN CHANGE THE LIGHT INTO SUGAR AND STARCH. THE PLANT STORES THE SUN'S ENERGY UNTIL IT IS CONSUMED. IF A PERSON OR AN ANIMAL EATS THE PLANT, ENERGY IS RELEASED. THE BODY THEN USES OR STORES THE ENERGY OF THE SUN. PEOPLE CAN ALSO GET ENERGY FROM EATING THE MEAT OF ANIMALS SUCH AS CHICKENS, PIGS, OR CATTLE.



THE FOOD ENERGY CHAIN !!

WHEN LEAVES AND WOOD ARE BURNED THE STORED ENERGY FROM THE SUN IS RELEASED IN THE FORM OF HEAT AND LIGHT. THIS RELEASE OF ENERGY IS SIMILAR TO WHAT HAPPENS INSIDE THE HUMAN BODY ONLY MUCH FASTER. WHEN YOU BURN WOOD IN A FIREPLACE YOU ARE USING SOLAR ENERGY.

DRAW A PICTURE OF YOUR HOME.

HOW DO YOU KEEP YOU HOME WARM?

_____

_____

_____

HOW DID PEOPLE HEAT THEIR HOMES A LONG TIME AGO?

_____

_____

_____

WHY CAN'T ALL OF US HEAT OUR HOMES THIS WAY TODAY?

_____

_____

_____

WHAT HAS HAPPENED TO THE NUMBER OF PEOPLE WHO LIVE IN OUR COUNTRY?

1. THERE ARE THE SAME NUMBER OF PEOPLE TODAY AS THERE WERE A LONG TIME AGO.

2. THERE ARE A LOT MORE PEOPLE IN OUR COUNTRY TODAY THAN THERE WERE A LONG TIME AGO.

3. THERE ARE FEWER PEOPLE IN OUR COUNTRY TODAY THAN THERE WERE A LONG TIME AGO.

WHICH SENTENCE ABOVE IS CORRECT? _____

WHAT HAS HAPPENED TO THE COST OF HEATING OUR HOMES?

_____

_____

HOW CAN YOU HELP BRING YOUR HEATING COSTS DOWN?

_____

_____

IS YOUR HOME PROPERLY INSULATED?

_____

WHERE COULD MORE INSULATION BE ADDED TO BRING THE COST OF HEATING EVEN LOWER?

_____

_____

_____

_____

ENERGY CONSERVATION CHECKLIST FOR YOUR HOME

HOW MUCH ENERGY DO YOU SAVE?
TAKE THIS LIST HOME. LOOK AROUND.
CIRCLE "Y" FOR THE THINGS YOU HAVE TO DO.
CIRCLE "N" FOR THINGS YOU DO NOT HAVE OR DO NOT DO.
IF YOU ARE NOT SURE HAVE MOM OR DAD HELP YOU.

EXTERIOR

Y N DO YOU HAVE STORM WINDOWS?

Y N DO YOU HAVE TIGHT FITTING DOORS AND WINDOWS?

Y N DO YOU HAVE BRICK OR WOOD WITH CRACKS NOT PATCHED?

Y N DO YOU HAVE ANY DOORS THAT OPEN TOWARD THE NORTH?

Y N DO YOU HAVE STORM DOORS?

Y N DO YOU HAVE INSULATED GLASS?

ATTIC OR LOFT

Y N DO YOU HAVE INSULATION IN YOUR ATTIC FLOOR?

Y N DO YOU HAVE VENTS IN THE ATTIC OR LOFT?

Y N DO YOU HAVE CIRCULATION FANS?

KITCHEN

Y N DO YOU PREHEAT THE OVEN LONGER THAN 10 MINUTES? (ONLY FOOD WITH YEAST AND PASTRY REQUIRE A PREHEATED OVEN.)

Y N DO YOU TRY TO COOK AS MANY THINGS AS POSSIBLE IN THE OVEN AT THE SAME TIME?

Y N DO YOU AVOID OPENING THE OVEN DOOR? (OPENING THE OVEN DOOR CAN CAUSE AS MUCH AS 20% HEAT LOSS.)

Y N DO YOU AVOID USING THE OVEN TO WARM UP THE ROOM?

Y N DO YOU HAVE AN ELECTRIC OVEN?

Y N DO YOU HAVE A GAS OVEN?

Y N DO YOU COVER PANS WHENEVER POSSIBLE?

Y N DO YOU AVOID VIOLENT BOILING?

KITCHEN (Continued)

Y N DO YOU FIX FLAMES OR HEAT SETTINGS TO SIZE OF PAN?

Y N DO YOU MAKE USE OF KITCHEN EXHAUST FAN?

WATER HEATERS

Y N DO YOU HAVE ANY LEAKY FAUCETS?

Y N ARE YOUR HOT WATER PIPES INSULATED?

Y N DO YOU TAKE SHOWERS? (SHOWERS USE ABOUT HALF AS MUCH HOT WATER AS AN AVERAGE TUB BATH.)

Y N IF YOU TAKE A BATH DO YOU LET THE WATER STAND SO THE HEAT GOES INTO THE ROOM?

Y N DO YOU USE A DISHPAN FOR RINSING WHEN THE DISHES ARE DONE BY HAND?

Y N DO YOU USE YOUR DISHWASHER FOR STORAGE UNTIL YOU HAVE A FULL LOAD?

Y N DO YOU WASH YOUR CARS OR TRUCKS USING HOT WATER?

LAUNDRY

Y N DO YOU DO FULL LAUNDRY LOADS?

Y N DO YOU USE COLD WATER WHEN POSSIBLE?

Y N DO YOU USE PROPER CYCLES?

Y N DO YOU DRY FABRICS OUTSIDE WHEN PRACTICAL?

Y N DO YOU DRY WITH ONLY FULL LOADS IN THE DRYER?

Y N DO YOU HAVE THE DRYER VENTED PROPERLY?

Y N DO YOU CLEAN LINT TRAPS REGULARLY?

WHAT KIND OF ENERGY USER ARE YOU?

HOW MANY OF THEM DO YOU HAVE?

IF YOU ARE NOT SURE HAVE MOM OR DAD HELP YOU.

IF YOU HAVE THE ENERGY USER CIRCLE THE "Y."

IF YOU DO NOT HAVE THE ENERGY USER CIRCLE THE "N."

ELECTRICAL APPLIANCES FOR HOBBIES, AMUSEMENT, RECREATION, DO-IT-YOURSELF

Y	N	AQUARIUM FILTER AND HEATER	Y	N	BARBEQUE
Y	N	CALCULATOR	Y	N	DOG CLIPPERS
Y	N	ERASER	Y	N	MOVIE PROJECTOR
Y	N	ORGAN	Y	N	PENCIL SHARPENER
Y	N	PHOTO ENLARGER	Y	N	POWER TOOLS
Y	N	RADIO	Y	N	TOYS
Y	N	TAPE RECORDER	Y	N	_____
Y	N	TELEVISION	Y	N	_____
Y	N	STEREO/TAPE PLAYER	Y	N	_____

ELECTRIC HOUSEWARES

Y	N	BABY FOOD WARMER	Y	N	GRIDDLE
Y	N	BEAN POT OR SLOW COOKER	Y	N	ICE CREAM FREEZER
Y	N	BLENDER	Y	N	ICE CRUSHER
Y	N	BOTTLE WARMER	Y	N	MICROWAVE OVEN
Y	N	TOASTER OVEN	Y	N	TOASTER
Y	N	CAN OPENER	Y	N	WAFFLE IRON
Y	N	CARVING KNIFE	Y	N	WARMING TRAY
Y	N	CORN POPPER	Y	N	_____
Y	N	FOOD MIXER OR GRINDER	Y	N	_____

Y	N	BLENDER	Y	N	ICE CRUSHER
Y	N	BOTTLE WARMER	Y	N	MICROWAVE OVEN
Y	N	TOASTER OVEN	Y	N	TOASTER
Y	N	CAN OPENER	Y	N	WAFFLE IRON
Y	N	CARVING KNIFE	Y	N	WARMING TRAY
Y	N	CORN POPPER	Y	N	_____
Y	N	FOOD MIXER OR GRINDER	Y	N	_____

ELECTRIC APPLIANCES PROVIDING PERSONAL COMFORT, CONVENIENCE, HYGIENE AND APPEARANCE

Y	N	AIR CONDITIONER	Y	N	HEAT LAMP
Y	N	BLANKET	Y	N	HOT COMB
Y	N	CLOCK	Y	N	LIGHTED MIRROR
Y	N	CURLING IRON	Y	N	SHOE POLISHER
Y	N	CURLERS	Y	N	TOOTHBRUSH
Y	N	DEHUMIDIFIER	Y	N	VAPORIZER
Y	N	HUMIDIFIER	Y	N	WATER PIC

RECYCLING

RECYCLING IS TO USE MATERIALS OVER AND OVER. TO DO THIS, WE MUST BE ABLE TO SORT THE MANY DIFFERENT KINDS OF THINGS WE USE. SOME OF THESE THINGS ARE:

ALUMINIUM PAPER GLASS IRON STEEL TIN COPPER

FIND A MAGNET AROUND HOME AND USE IT TO TEST AS MANY THROW-AWAY ITEMS AS YOU CAN. (HOW MANY MAGNETS DID YOU FIND? _____)
WHAT KINDS OF THINGS CAN THE MAGNET PICK UP?

CAN YOU TELL HOW A MAGNET COULD BE USED TO SEPARATE GARBAGE?

WHAT THINGS ARE NOT PICKED UP BY A MAGNET?

CAN YOU THINK OF A WAY TO SEPARATE THESE THINGS?

HOW CAN YOU HELP SEPARATE THINGS FOR RECYCLING AT HOME?

WHAT CAN YOU DO WITH EACH OF THESE THINGS SO IT IS RECYCLED?

ARE MOM AND DAD WILLING TO HELP?

Junior High Energy Education Activities

With the abrupt change between the junior high and the elementary schools, in terms of organization and curriculum, comes an equally significant change in the approach to energy education. Increased departmentalization and a greater variety of courses allow for a more widespread emphasis on the energy problem in the classroom. Almost every subject area can become involved if the teachers are innovative and willing to develop their own units. Teachers can capitalize on the ideas developed in the elementary school to bring the entire situation into a sharper focus. With the advantage of working with more mature students, significant changes in attitude toward energy use should be noticeable.

At these grade levels students should become well versed in all viable current sources of energy as well as the realities concerning future alternative sources of energy.

The concepts that were introduced at the intermediate level should be reviewed and reemphasized at this level. Special regard should be given to the particular concepts of energy economics, environmental trade-offs, and energy best-use.

The basic goals to be achieved at this level are that students realize the cost involved in maintaining our present way of life and the need to adjust our way of life to more realistic levels.

The activities included in this section are based on traditional junior high school organization. For the average teacher it is important to realize that every department or subject area is important in developing a realistic attitude on the part of students toward energy if our society is to continue to exist in its present framework.

Activities - Junior High 7-9

Art

1. Conduct a project to study the energy consumption in making paper or recycling paper.
2. As a part of art history do a comparison of past and present techniques for firing pottery.

Home Economics

1. Study energy conservation techniques in cooking such as advanced meal planning, multiple meal cooking; frozen or "fast" food use as compared to conventional cooking.
2. Study energy conservation techniques for home heating and cooling such as using drapes, using fireplaces, window locations and sizes when planning to build or remodel.

Industrial Arts

1. Consider recommended requirements for insulation as well as various types and proper installation techniques in existing as well as planned construction.
2. Discussion of home heating and cooling equipment should include conventional oil, gas, and electricity as well as newer technologies such as solar, heat pumps, and passive systems such as ground berms or house placement.

Career & Consumer Education

1. Help students learn how to read electric and gas meters, how to read fuel bills, the role they play in budgeting and how to reduce bills.
2. Have students consider the scope of job opportunities associated with energy (for example architecture, automotive design, mass transit, service stations, mining, engineering of all kinds, transportation of goods and services, etc.)

Environmental Education

1. Compare the impact of solar, nuclear, coal, oil, and gas on the environment in terms of air quality, water quality and land disruption.
2. Have students consider energy conservation practices involving transportation of people, goods, and services emphasizing the concept of how much energy is consumed per unit transported.

Math

1. By using the included numerical energy charts teachers and/or students can develop story or other problems which use energy units so that students become familiar with them. Examples - British Thermal Units, calories, therms, cubic feet, barrels, tons, etc.
2. Percentage problems can be developed which illustrate rate changes, increase or decrease in use of energy sources and projections of future energy consumption.

Health

1. Have students discuss the problems associated with the use of coal or some other mined energy source, how that mining affects the public and the desirability of continuing to use that resource.
2. Consider the effects of changes in home heating and cooling practices on the health of various age groups.

Language Arts

1. Give writing assignments that deal with current energy topics or futuristics of the energy/environment situation.
2. Establish speech or debate topics that concentrate on the controversies associated with our use of energy.
3. As part of a dramatics unit develop simulation/role playing activities which highlight the controversies in energy use and conservation.

Life Science

1. Study the energy conversions which take place in plants (photosynthesis) which give us a variety of energy sources. Examples - coal, oil and gas formation, biomass, wood, etc.
2. Consider the natural waste products from animals or agriculture and their use in methane generation.

Physical Science

1. Discuss the technologies involved in the generation, distribution and use of electrical energy.
2. Consider the technology necessary for the future development and use of solar power, wind, fusion, geothermal

Social Studies

1. Conduct an in-depth study of a person's use of energy from prehistory through the present time and its influence upon cultural migration, and the development of various societies.
2. Study the geographic distribution of energy sources and what would affect the development and use of these sources.

Earth Science

1. Have students consider the types of geologic formations in which coal, gas, oil, uranium, geothermal and other energy sources are found.
2. Investigate the distribution of water in the world as it relates to the development and use of various energy sources.

Senior High School Energy Education Activities

The energy problem should be approached from two directions in the senior high school because of the upcoming educational decisions of the students. One segment of the student population will be terminating their formal education while another portion will continue with more advanced schooling.

For the students who are not going on to school, their role as a consumer should be stressed as it is determined by our present life style and attitudes and then compared to the need for changes in the future. As consumers these people will impact the use of energy in three major areas - buying products, transportation, and home use. It is very important for this new group of consumers to recognize the importance of everyday decisions that they will be making. The type of car they choose to drive and where they work, the type of dwelling, its location, and its construction, and the attitudes they develop towards purchasing products are all critical.

Decisions in these areas can be greatly affected by the exposure these students receive in their final years of schooling.

The other major segment of students attending high school also needs exposure to similar information, but they must also have the opportunity to delve into the theoretical and abstract areas of energy research. Activities must be

planned for these students that will cause them to pursue greater inquiry on their own. Problem-solving techniques and basic inquiry methods should be stressed in as many academic areas as possible.

The activities included in this section have not been divided up into any specific categories. If additional or more specific approaches are desired, the junior high section should be consulted.

Activities - Senior High 10-12

1. Have the students gather the necessary data on devices that use electricity so that they can compile a list and then determine the cost of operating the device for one hour.
2. Have the students do research on the amount of energy needed to manufacture common home appliances, automobiles, etc.
3. Have the students determine the amount of energy used by various devices in the school.
4. Have the students do research on the topic of the amount of energy needed to maintain the environmental quality of a coal-burning generating station which uses electrostatic precipitators, scrubbers, etc. Include in this the energy needed to transport the waste products.
5. Let each student pick one energy source and have the student research the processes which make that energy source usable in our society (or how much work has to be

done so we can use the energy). Some energy sources are very difficult to make usable. One thing for them to consider is the geographic location of the source of energy.

6. Have the students prepare diagrams of how primary energy sources are converted to a more usable form such as: coal, oil, gas, and nuclear into electricity.
7. Have the students research the practicality and cost of using solar energy to produce electricity (photovoltaic cells).
8. Have the students determine what the "best use" is for each basic energy form (oil for petrochemicals, for instance).
9. Have students consider the environmental impact of building a hydroelectric dam.
10. Have the students determine which energy form creates the greatest effect on the environment in extracting the fuel from the earth: coal, oil, natural gas, uranium.
11. Have the students determine which fuel produces the greatest amount of waste that has to be disposed of after it has been used.
12. Using models or diagrams of internal combustion engines, discuss efficiency ratios (fuel consumed for desired results).
13. Construct models or diagrams of solar conversion systems (thermal and photovoltaic) outlining the best uses for each.

14. Obtain some coal and burn it as a lump and again after it has been pulverized. Use this to open up a discussion on efficiency of conversions, emissions into the air, available resources, geographic locations, and the amount of energy available in the various grades of coal.
15. Use diagrams of nuclear powered generating plants to explain the basic operation. Use this as a lead-in for a discussion on licensing, safety, and hazards.
16. During this portion of the unit, obtain resource people from the major energy producers to talk to your students on various aspects of the problems of energy production.
17. Have students research the topic, "Which is easier and cheaper to transport, coal or electricity?" Introduce the concept of unitrains and transmission lines.
18. Have students research the environmental, social, and industrial controversy surrounding the building of the Alaska pipeline.

    Why do we need it?

    What harm has it done?

    What harm will it cause?

    What are the alternatives to the pipeline?

    How many jobs has it provided or will it provide?
19. Have students research the Arab oil embargo of 1973, its impact on the United States, and the concept of energy independence.
20. Have students do creative writing assignments on the topics of a future embargo of oil from the Arab nations

and should the United States try to control the internal affairs of another nation.

21. Have students debate the topic: "Energy independence is the most important problem facing the United States today."
22. Have students make charts on which they pilot predicted U.S. energy demands and the available resources which will supply those needs. Make sure you have them note conflicting statistics on known reserves and existing technology used to create usable energy.
23. Have students prepare a debate on environmental quality versus industrial output.
24. Have students debate the topic of building a nuclear power plant in their town.
25. Develop (or use) a simulation game in which all special interest groups are involved in deciding what to do about a new proposed industrial park in their city, zero population growth, or building a central solar generating station.
26. Assign students to diagram flow charts on energy resources, environmental impacts, and waste disposal for each of the major energy sources.
27. Assign students to write their state and national congress persons stating their opinions on energy conservation.
28. Assign students to research their school to determine what portion of it consumes the greatest amount of energy.

Secondary Energy Education Charts

The charts, graphs, illustrations, and tables included in this section are designed to be used by energy teachers at a variety of secondary grade levels. The simple line drawings and numerical charts can be readily adapted to meet specific classroom needs. Please understand that this set is not all inclusive by any means but is presented as a place to begin. An almost endless supply of materials is available if the teacher is motivated to collect them all.

After checking through this section it is hoped that the concerned teachers will use their own creativity to develop additional materials which will reflect the specific emphasis which each feels is important.

ENERGY UNITS AND CONVERSIONS

1 BTU (BRITISH THERMAL UNIT) IS THE ENERGY REQUIRED TO HEAT 1 POUND OF WATER 1 DEGREE FAHRENHEIT.

1 CALORIE IS THE ENERGY REQUIRED TO HEAT 1000 GRAMS OF WATER 1 DEGREE CELSIUS.

CURRENT U.S. ENERGY CONSUMPTION

= 75 QUADRILLION BTU'S PER YEAR (75,000,000,000,000,000)
= EQUIVALENT OF 35 MILLION BARRELS OF OIL PER DAY

ONE QUAD	=	1 QUADRILLION BTU (10^{15})
	=	180 MILLION BARRELS OF OIL
	=	42 MILLION TONS (38 MILLION METRIC TONS) OF BITUMINOUS COAL
	=	0.98 TRILLION CUBIC FEET (0.027) TRILLION CUBIC METERS) OF NATURAL GAS
	=	293 BILLION KILOWATT HOURS OF ELECTRICITY
	=	16.5 TONS OF URANIUM ORE
	=	1.25 BILLION TONS OF WOOD

1 BARREL (42 GALLONS) OF OIL	=	5.8 MILLION BTU'S
1 TON EASTERN COAL	=	26 MILLION BTU'S
1 POUND EASTERN COAL	=	13 THOUSAND BTU'S
1 TON LOW-SULFUR WESTERN COAL	=	18 MILLION BTU'S
1 POUND LOW-SULFUR WESTERN COAL	=	9 THOUSAND BTU'S
1 CORD (2½ TONS) OF WOOD	=	13 TO 27 MILLION BTU'S
1 POUND OF URANIUM ORE	=	200 MILLION BTU'S*
1 POUND OF URANIUM ORE	=	30 BILLION BTU'S**
1 CUBIC FOOT OF NATURAL GAS	=	1070 BTU'S
1 KILOWATT-HOUR OF HEAT	=	3413 BTU'S
1 KILOWATT-HOUR OF ELECTRICITY	=	9000 BTU'S***

* CONVERTED IN LIGHT WATER REACTOR
** TOTAL FISSION ENERGY
*** AT 38% NET EFFICIENCY FOR CONVERTING HEAT TO ELECTRICITY

ENERGY CONVERSION FACTORS

MULTIPLIER UNITS:

GIGA	1 BILLION
MEGA	1 MILLION
KILO	1 THOUSAND
MILLI	1 THOUSANDTH
MICRO	1 MILLIONTH

1 KILOWATT	=	1,000 WATTS
	=	0.24 CALORIES/SEC.
	=	0.96 OR 1 BTU/SEC.
	=	1.3 HORSEPOWER (HP)
1000 KILOWATTS	=	1 MEGAWATT
1 KILOWATT-HOUR	=	3413 BTU
	=	1.35 HP-HR
	=	860 CALORIES
1 HORSEPOWER	=	0.75 KILOWATT
	=	0.71 BTU'S/SEC.

HOW TO CONVERT ENERGY MEASUREMENTS

TO CHANGE	TO	MULTIPLY BY
KILOWATT HOUR (KWH)	B.T.U.	3,412.8
1 BARREL (42 GAL.) CRUDE OIL	B.T.U.	5,600,000
1 BARREL NO. 5 RESIDUAL OIL	B.T.U.	6,290,000
1 GALLON NO. 2 HEATING OIL (HOME HEATING AND DIESEL)	B.T.U.	138,000
1 GALLON GASOLINE	B.T.U.	125,000
1 TON COAL (BITUMINOUS)	B.T.U.	26,200,000
1 THERM NATURAL GAS	B.T.U.	100,000
1 CUBIC FOOT NATURAL GAS	B.T.U.	1,031
1 BRITISH THERMAL UNIT (B.T.U.)	B.T.U.	0.000293

Conservation Checklist for Your Home

This checklist is provided so that you can determine how well your home is conserving heat and energy.

Circle "Y" for YES and "N" for NO.

I. Exterior
Do you . . . . . .?

Y N Have brick and/or wood siding

Y N Have only brick siding

Y N Have storm windows

Y N Have tight fitting doors and windows

Y N Have brick or wood with cracks not caulked

Y N Have trees for wind screens and sun protection

Y N Have any doors that open toward the north

Y N Have storm doors

Y N Have insulated glass

Y N Have three pane window glass tinted with dead air space between

Y N Have awings over windows

Y N Have patio cover

II. Attic or Loft
Do you . . . . . .?

II. (Continued)

Y N Have adequate insulation--in attic floor

Y N Have ventilator installed in the attic or loft

Y N Have vents in the eaves

Y N Have circulation fans

Y N Have insulation between rafters

Y N Have storage in the loft or attic

III. Laundry
Do you . . . . . .?

Y N Do maximum size loads

Y N Use correct temperature settings

Y N Use appropriate cycles for fabrics

Y N Use cold water where possible (example: rinse with cold)

Y N Use proper cycles for size of load

III. (Continued)

Y N Clean lint traps regularly

Y N Dry fabrics outside when practical

Y N Dry only full loads with dryer

Y N Have dryer vented properly

IV. Water Heaters
Do you . . . . . .?

Y N Drain monthly and remove sediment

Y N Have the correct capacity for your home

Y N Have controlled temperature settings (140 to 150 best settings for most kitchens and laundry needs)

Y N Fix any and all leaky faucets

Y N Insulate hot water pipes

Y N Watch your use of hot water

Y N Take showers (showers use about half as much hot water as an average tub bath)

Y N Use a dishpan for washing and rinsing when by hand

Y N Use your dishwasher for storage until you have a full load

Y N Wash your cars or trucks using hot water

V. Central Heating Systems
Do you . . . . . .?

Y N Have a yearly maintenance service performed on your furnace by professionals

Y N Have forced air heat

Y N Oil the blower (or grease)

Y N Oil the motor (or grease)

Y N Change or clean the filters frequently (2 times a season is recommended by most furnace manufacturers)

Y N Clean the humidifier

Y N Check ducts for leaks or separations

Y N Have the correct amount of insulation around the pipes or airways

VI. Air Conditioning
Do you . . . . . .?

A. Interior

Y N Overcool (the temperature difference between indoors and out should not exceed 15 degrees)

Y N Keep air filters clean

Y N Have drapes or furniture obstructing the air

Y N Shade window from direct sun in summer with awnings or trees

Y N Close or seal all passages or openings between air-conditioned space and the attic or loft including cracks around doors, windows, and stairways

Y N Keep up maintenance of forced air system

Y N Change filters

Y N Oil blowers

Y N Keep condensation

Y N Block chimneys with draft block or close draft on chimney with any means available

B. Exterior (Air Conditioning)

Y N Maintain outdoor unit for most efficient

Y N Cover unit outdoors when not in use

Y N Paint unit

Y N Grease as required by manufacturer

Y N Lubricate when required

Y N Clean extraneous or foreign materials such as grass, straw, sticks, bird nest, etc.

VII. Kitchen
Do you . . . . . .?

A. Oven

Y N Preheat too long (Don't preheat longer than 10 minutes, and then only leavened foods and pastry require a preheated oven.)

Y N Try to cook as many things as possible in the oven at the time

Y N Avoid opening the oven door (Opening the oven door can cause as much as 20% heat loss.)

Y N Avoid using the oven to warm up the roon

Y N Have an electric oven

Y N Have a gas oven

Y N Have an oven other than gas or electric

VII. (Continued)

B. Range

Y	N	Cover pans whenever possible
Y	N	Avoid violent boiling
Y	N	Tailor flame or heat settings to size of pan
Y	N	Use controlled burner whenever possible
Y	N	Make use of kitchen exhaust fan

Fact Sheet

FOR YOUR ENERGY INFORMATION
USAGE CHART

The following list of appliances shows, in the first column, the average wattage of such an appliance; in the second column, the average number of hours the appliance is used in one year; and in the third column, the total number of kilowatt hours for each appliance over one year.

APPLIANCE	AVERAGE WATTAGE	AVERAGE HOURS PER YEAR	Kwh PER YEAR	RANK[1]
Air cleaner	50	4,320	210	5
Air conditioner	1,566	887	1,389	
Bed covering	177		147	
Blanket	177	831	147	
Blender	386	38.9	15	
Broiler	1,436	69.7	100	
Carving knife	92		8	
Clock	2	8,500	17	
Clothes Dryer	4,856	204	993	
Coffeemaker	894	119.0	106	
Deep fryer	1,448	57.3	83	
Dehumidifier	257	1,467	377	
Egg cooker	516		14	
Fan, attic	370	786	291	
Fan, circulating	88	489	43	
Fan, rollaway	171	807	138	
Fan, window	200	850	170	
Floor polisher	305	49.2	15	
Freezer, 15 cu. ft.	445	3,405	1,195	7
Freezer, frostless 15 cu. ft.	440	4,002	1,761	4
Frying pan	1,196	157	188	
Germicidal lamp	20		141	
Hair dryer	381	36.7	14	
Heat lamp (infrared)	250		13	
Heater, portable	1,322	133	176	
Heating pad	65	154	10	
Hot plate	1,257	71.6	90	
Humidifier	177	921	163	
Iron, hand	1,008	143	144	
Mixer	127	102	13	
Oven, microwave	1,500	200	300	
Oven, self clean	4,800	239	1,146	9
Radio	71	1,211	86	
Radio/record player	109	1,000	109	
Range	8,200	128	1,175	8
Refrigerator, 12 c. ft.	241	3,021	728	

(1) Rank...ten greatest energy consumers in the home

APPLIANCE	AVERAGE WATTAGE	AVERAGE HOURS PER YEAR	Kwh PER YEAR	RANK[1]
Refrigerator/frostless, 12 cu. ft.	321	3,791	1,217	6
Refrigerator/frostless, 14 cu. ft.	326	3,448	1,137	10
Refrigerator/freezer 14 cu. ft.	615	2,947	1,829	3
Roaster	1,333	154	205	
Sandwich grill	1,161		33	
Sewing machine	75	147	11	
Shaver	14	129	1.8	
Sun lamp	279	57.3	16	
Toaster	1,146	34	39	
Toothbrush	7	7.14	0.5	
Trash compactor	400	125	50	
TV, black & white	237	1,527	362	
TV, color	332	1,512	502	
Vacuum cleaner	630	73	46	
Vibrator	40	50	2	
Waffle iron	1,116	19.7	22	
Washing machine, auto*	521	198	103	
Waste disposer	445	67.4	30	
Water heater	2,475	1,705	4,219	2
Water heater, quick recovery	4,474	1,705	4,811	1
Washing machine, non auto*	286	266	76	

*does not include hot water heating

ENERGY CONSUMER CHECKLIST

It may surprise you to discover that you have so many devices which require electricity. Place a check beside each of the following which you have in your home. Please add those which are not listed.

Major Electrical Appliances

_____ Clothes Dryer
_____ Clothes Washer
_____ Dishwasher
_____ Food Freezer
_____ Food Waste Disposal
_____ Ice Cube Maker
_____ Range (Stove)
_____ Refrigerator
_____ Trash Compactor
_____ Water Heater
_____
_____
_____

Electrical Housekeeping Appliances

_____ Floor Polisher
_____ Floor Scrubber
_____ Iron
_____ Rug Shampooer
_____ Vacuum Cleaner
_____ Water Softener
_____
_____
_____

Electrical Appliances for Hobbies, Amusement, Recreation, Do-It-Yourself

_____ Adding Machine
_____ Aquarium Filter and Heater
_____ Barbeque
_____ Battery Charger
_____ Calculator
_____ Charcoal Lighter
_____ Dog Clippers
_____ Eraser
_____ Fireplace Log
_____ Movie Projector
_____ Organ
_____ Pencil Sharpener
_____ Piano
_____ Photo Enlarger
_____ Power Tools
_____ Radio
_____ Sewing Machine
_____ Scissors
_____ Slide Projector
_____ Soldering Iron
_____ Stereo/Tape Player
_____ Swimming Pool Filter
_____ Tape Recorder
_____ Television
_____ Toys
_____ Typewriter
_____
_____
_____
_____

Electrical Housewares

_____ Baby Food Warmer
_____ Bean Pot/Slow Cooker
_____ Blender
_____ Bottle Warmer
_____ Broiler-Toaster Oven
_____ Can Opener
_____ Carving Knife
_____ Chafing Dish
_____ Coffee Maker
_____ Corn Popper
_____ Deep Fat Fryer
_____ Dutch Oven
_____ Fondue Pot
_____ Food Mixer or Grinder
_____ Griddle
_____ Hot Plate
_____ Ice Cream Freezer
_____ Ice Crusher
_____ Juice Extractor
_____ Knife
_____ Microwave Oven

Electric Housewares (Continued)

_____ Rotisserie
_____ Sharpener
_____ Skillet
_____ Sterilizer
_____ Toaster
_____ Waffle Iron
_____ Warming Tray
_____ Yogurt Maker
_____
_____
_____

Electric Appliances Providing Personal Comfort, Convenience, Hygiene and Appearance

_____ Air Conditioner
_____ Air Purifier
_____ Blanket
_____ Clock
_____ Clothes Brush
_____ Curling Iron
_____ Curlers
_____ Dehumidifier
_____ Electrostatic Air Cleaner
_____ Evaporative Cooler
_____ Exerciser
_____ Fans, attic
_____ Fans, circulating
_____ Fans, Kitchen exhaust
_____ Foot and Back Massager
_____ Garage Door Opener
_____ Hair Clippers
_____ Heat Lamp
_____ Hot Comb
_____ Hot Lather Dispenser
_____ Heating and Blower
_____ Humidifier
_____ Lighted Mirror
_____ Manicure Set
_____ Range Hoodlight and Fan
_____ Shaver
_____ Reducing Machine
_____ Shoe Polisher
_____ Sun Lamp

_____ Toothbrush
_____ Vaporizer
_____ Water Pic
_____ Whirlpool bath
_____
_____
_____

Light Bulbs

_____ 60 Watts
_____ 75 Watts
_____ 100 Watts
_____ 150 Watts
_____ ___ Watts
_____ ___ Watts
_____ ___ Watts
_____ ___ Watts

Go back and very carefully put a circle around the five things which you feel use the most electricity.

UNITED STATES FUEL CONSUMPTION

1900

COAL	6.840Q
WOOD	2.015Q
NATURAL GAS	.252Q
OIL	.229Q
TOTAL	9.336Q

1974

OIL	33.5Q
NATURAL GAS	22.2Q
COAL	13.2Q
HYDROPOWER	3.0Q
NUCLEAR POWER	1.2Q
TOTAL	73.1Q

Q QUADRILLION BTU

BTU BRITISH THERMAL UNIT

ENERGY NEEDED TO HAUL PEOPLE

1975

RAIL-ELECTRIC	900BTU PASSENGER-MILE
BUS	1,090BTU PASSENGER-MILE
RAIL-DIESEL	1,700BTU PASSENGER-MILE
AUTOMOBILE	8,500BTU PASSENGER-MILE
AIRPLANE	9,700BTU PASSENGER-MILE

BTU PASSENGER-MILE AMOUNT OF ENERGY NEEDED TO HAUL 1 PERSON A DISTANCE OF 1 MILE.

BTU BRITISH THERMAL UNIT

ENERGY NEEDED TO HAUL FREIGHT

1975

RAIL-ELECTRIC	320 BTU TON-MILE
RAIL-DIESEL	680 BTU TON-MILE
TRUCK	2,340 BTU TON-MILE
AIR	37,000 BTU TON-MILE

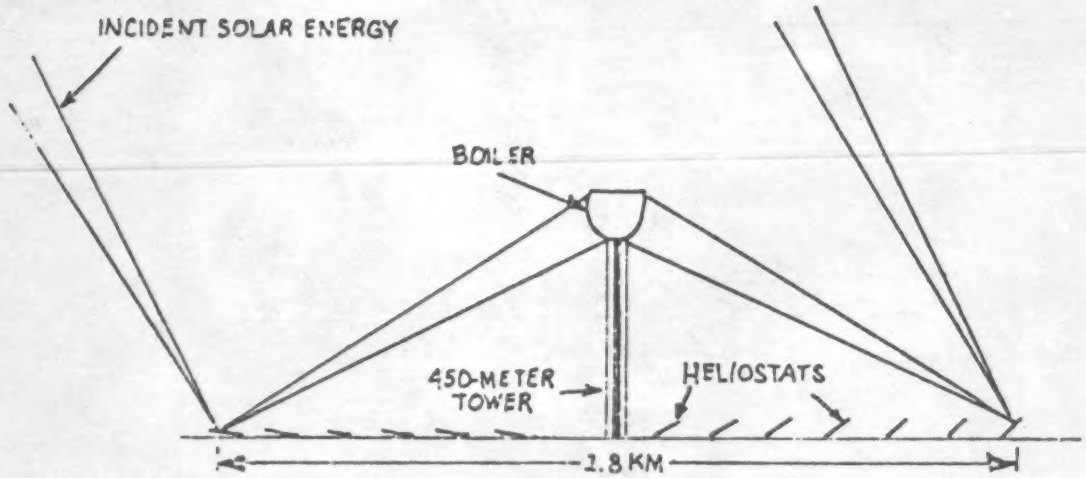
BTU TON-MILE AMOUNT OF ENERGY NEEDED TO HAUL 1 TON A DISTANCE OF 1 MILE

BTU BRITISH THERMAL UNIT

TWO EXAMPLES OF CENTRALIZED SOLAR COLLECTING STATIONS

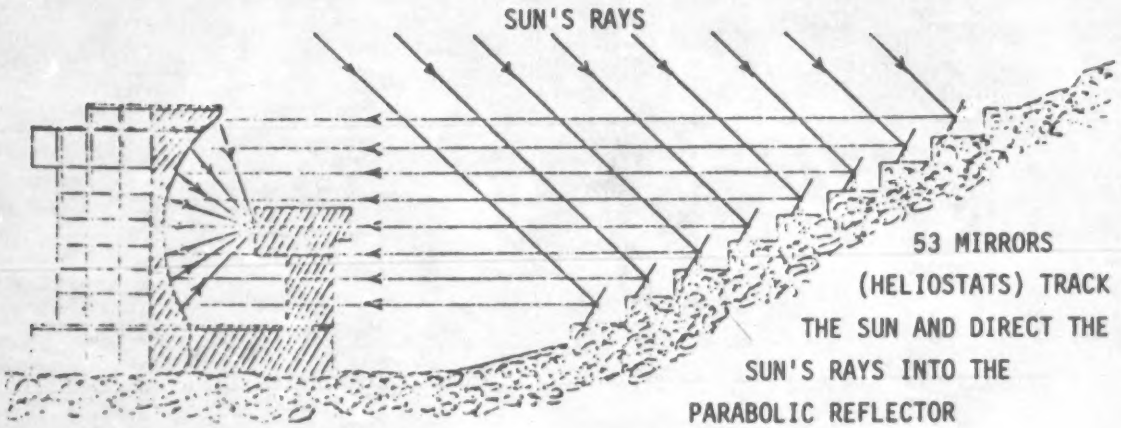
POWER TOWER

Cross-sectional view of a tower top focus solar energy collector.



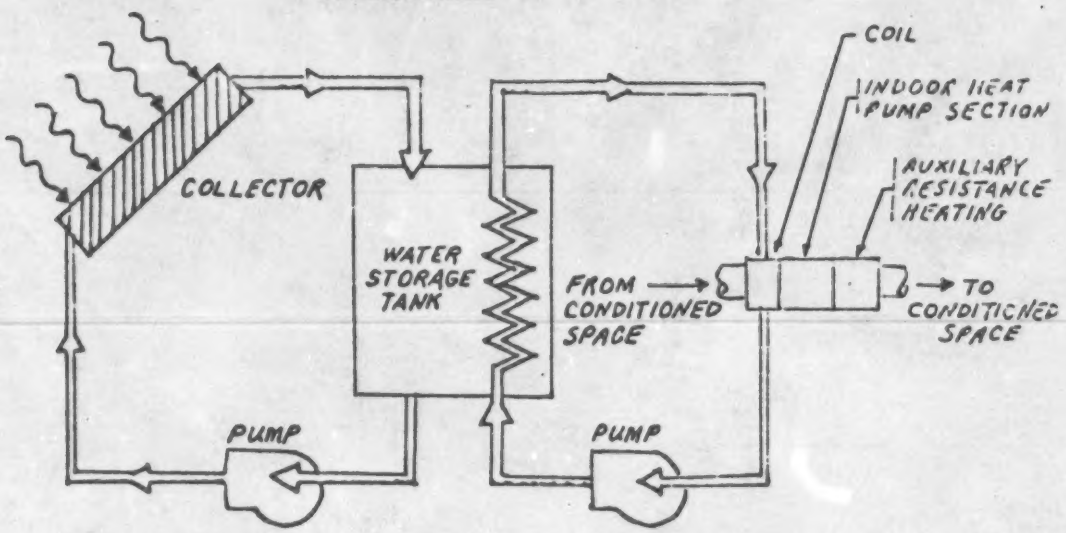
PARABOLIC REFLECTOR

(CURRENTLY OPERATIONAL ON AN EXPERIMENTAL BASIS)

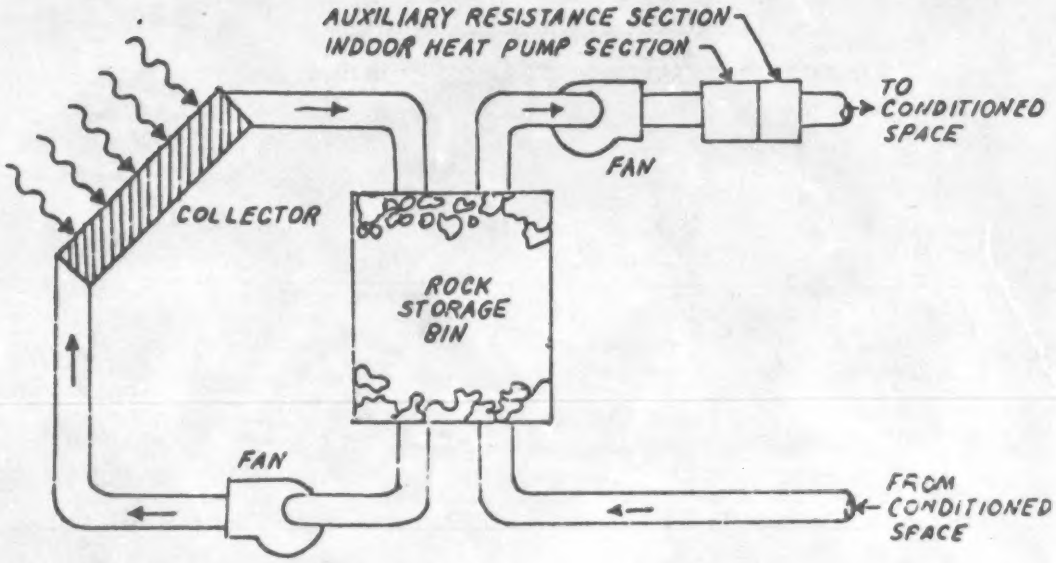

SUN'S RAYS
53 MIRRORS (HELIOSTATS) TRACK THE SUN AND DIRECT THE SUN'S RAYS INTO THE PARABOLIC REFLECTOR
PARABOLIC REFLECTOR CONCENTRATES SUN'S RAYS ONTO TARGET AREA

CONVENTIONAL SOLAR ENERGY COLLECTING SYSTEMS

FLUID TYPE

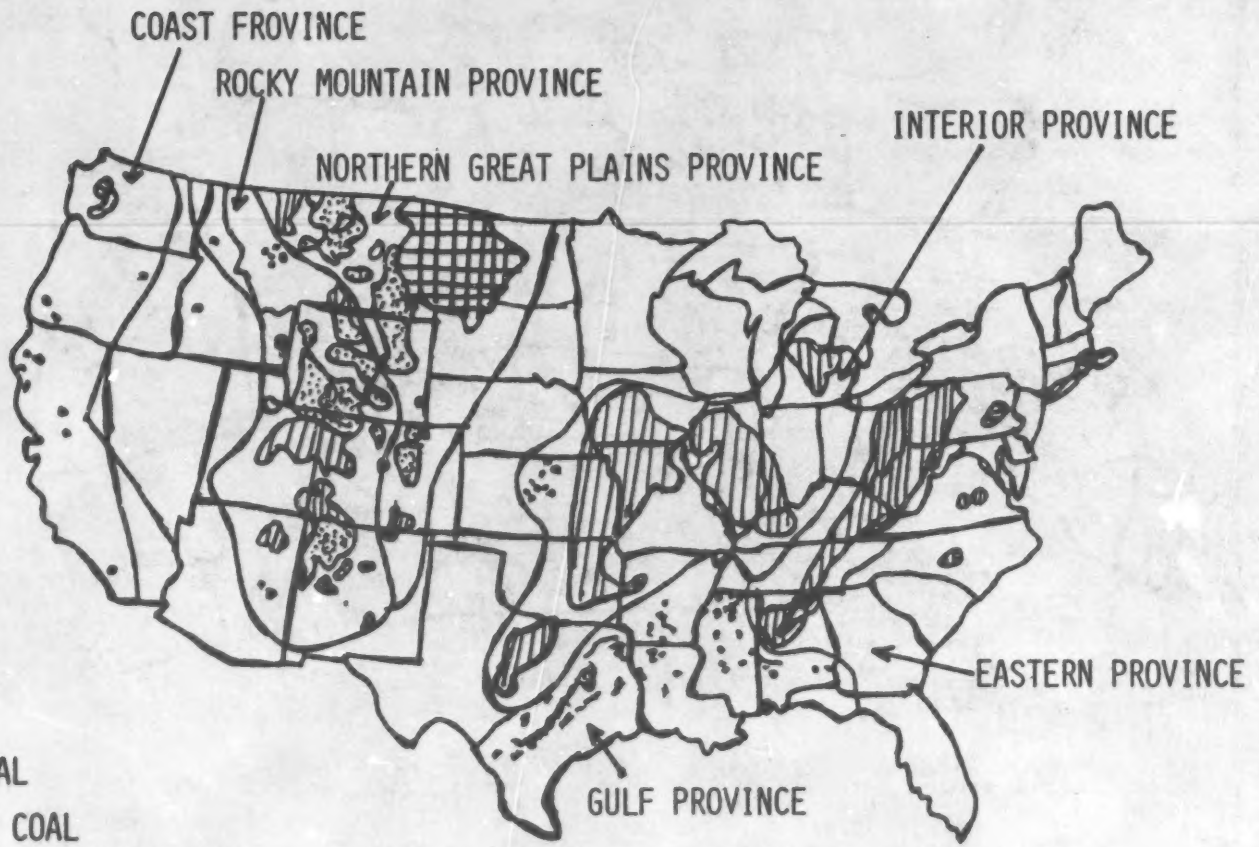


AIR TYPE



OIL AND GAS FIELDS IN THE UNITED STATES

DISTRIBUTION OF UNITED STATES COAL RESOURCES



6.18

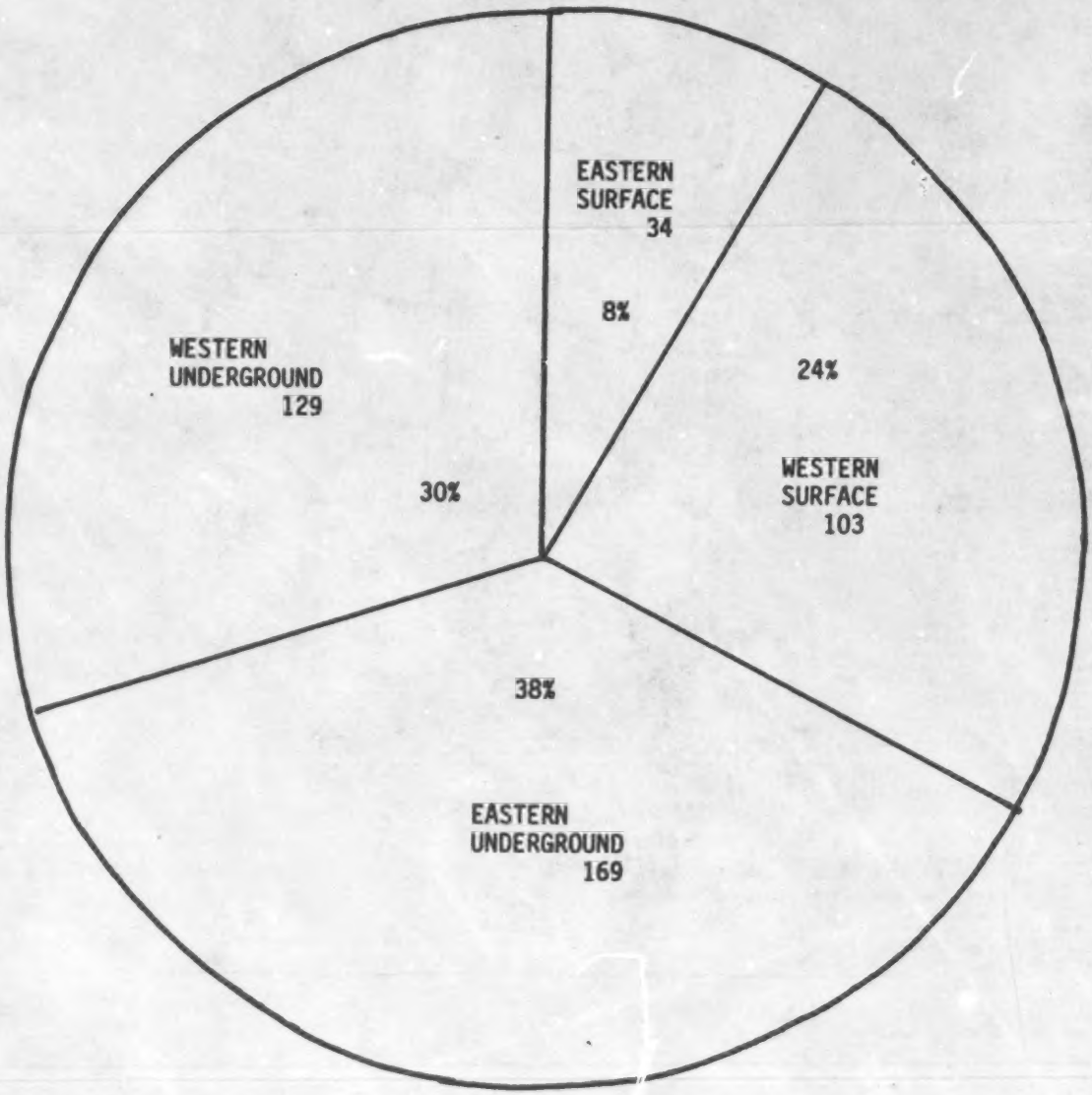
DISTRIBUTION OF UNITED STATES GEOTHERMAL RESOURCES

U.S. DEMONSTRATED COAL RESERVE BASE

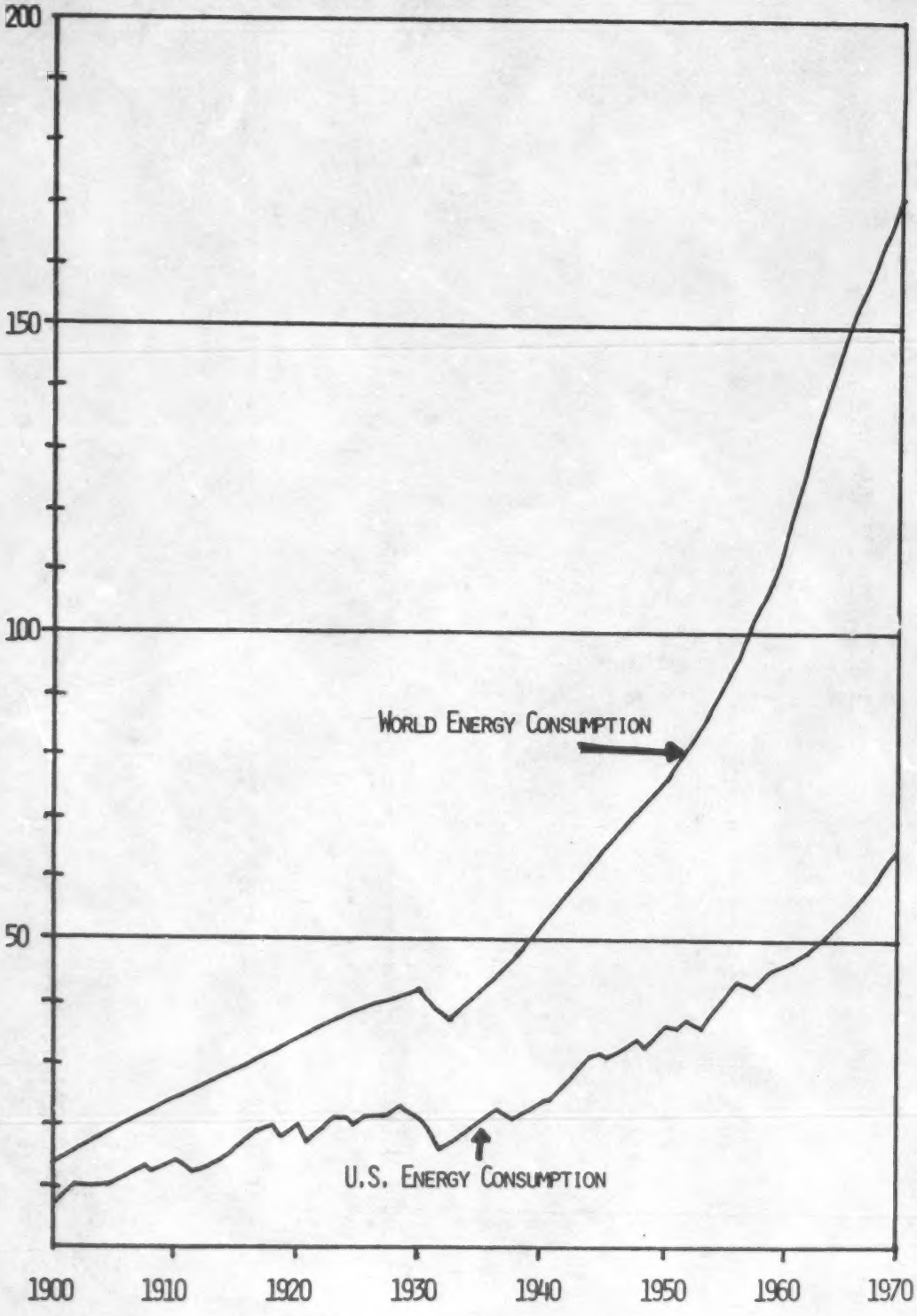
JANUARY 1974

BILLIONS OF SHORT TONS

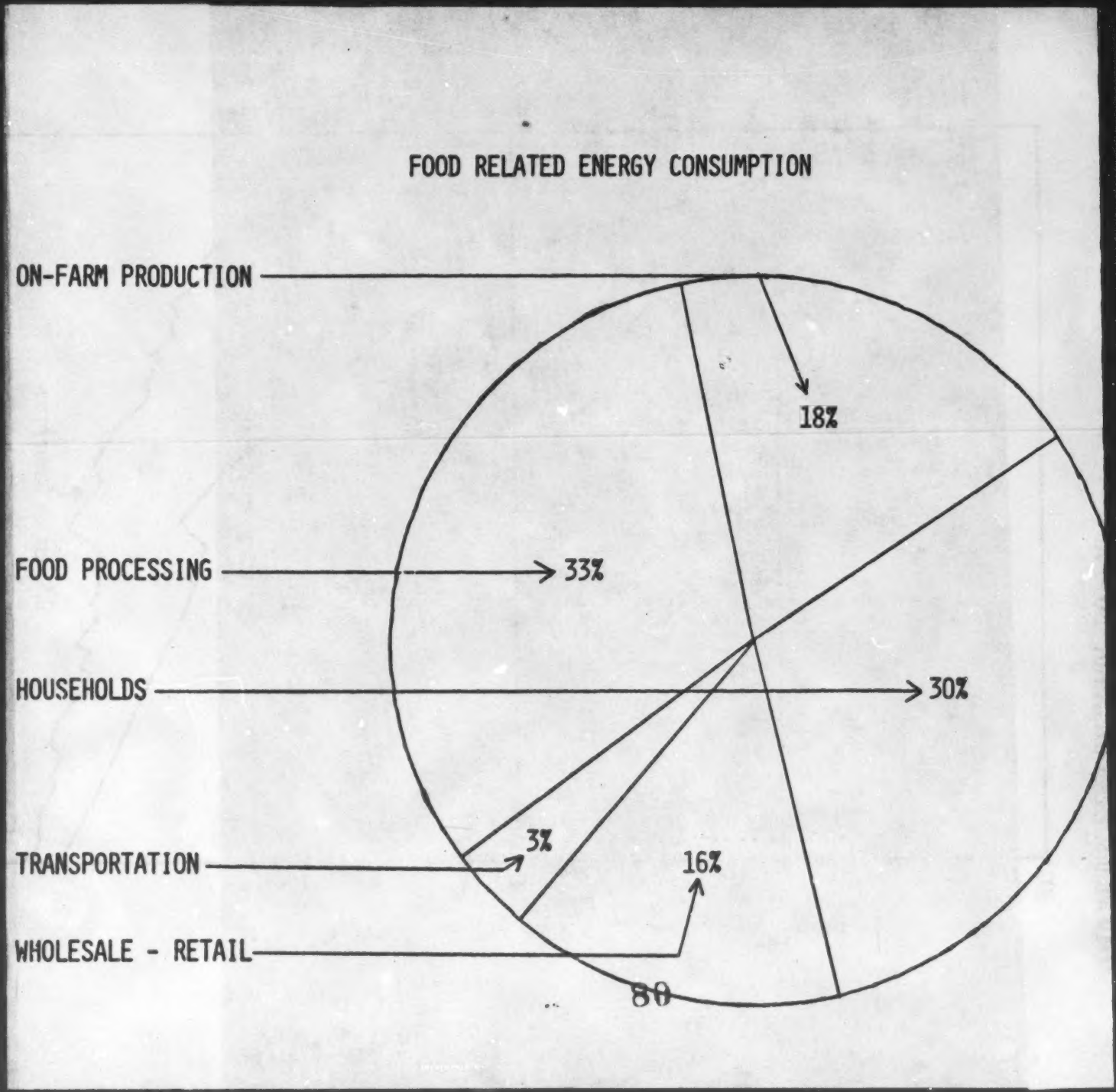
TOTAL: 434



WORLD AND U.S. ENERGY CONSUMPTION 1900-1970

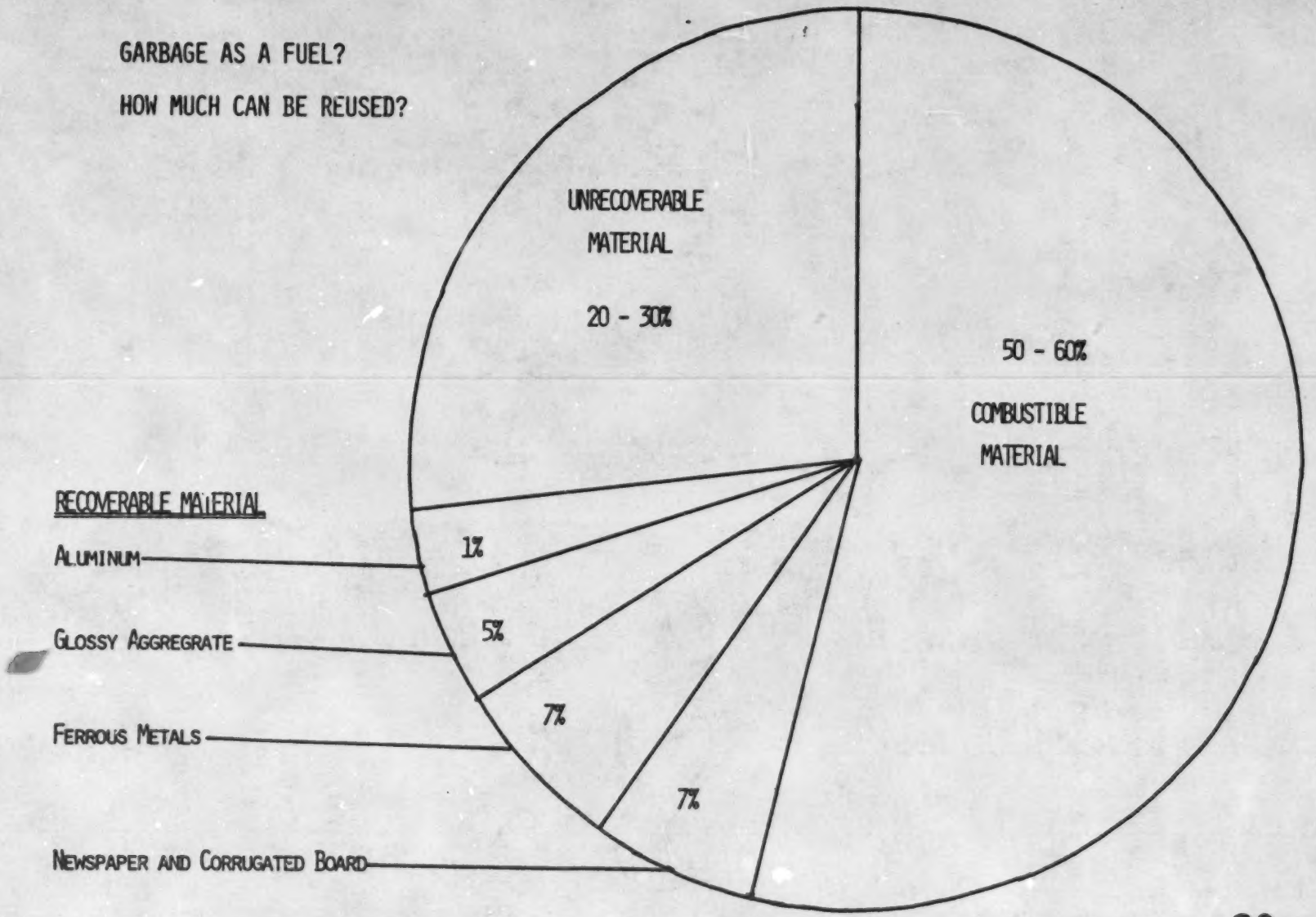


6.21


FOOD RELATED ENERGY CONSUMPTION
ON-FARM PRODUCTION
18%
FOOD PROCESSING
33%
HOUSEHOLDS
30%
TRANSPORTATION
3%
16%
WHOLESALE - RETAIL

GARBAGE AS A FUEL?

HOW MUCH CAN BE REUSED?



6.23

How To Calculate the Amount of Electricity Used

Before you can claculate the electricity consumed by your family, you must be able to read the dials of your watt-hour meter. Your meter may have four or five dials. The dials are like the face of a watch but only use the numbers 0 to 9. Every other dial moves counterclockwise. Notice that when the pointer is between two numbers, you read the lower or smallest number.

When the pointer seems to be directly on a number, look to the right; if the pointer on the right side dial has passed "0", then write down the number the pointer seems to be on; if the pointer on the right side dial has not passed "0", then write down the previous lower number on the dial you are recording.

Now, read the dials below.

Did you get 8192? If you did, then you read the meter dials correctly.

RECORD THE READINGS FOR THE FOLLOWING METERS

Meter I

Figure A _____

Figure B _____

Meter II

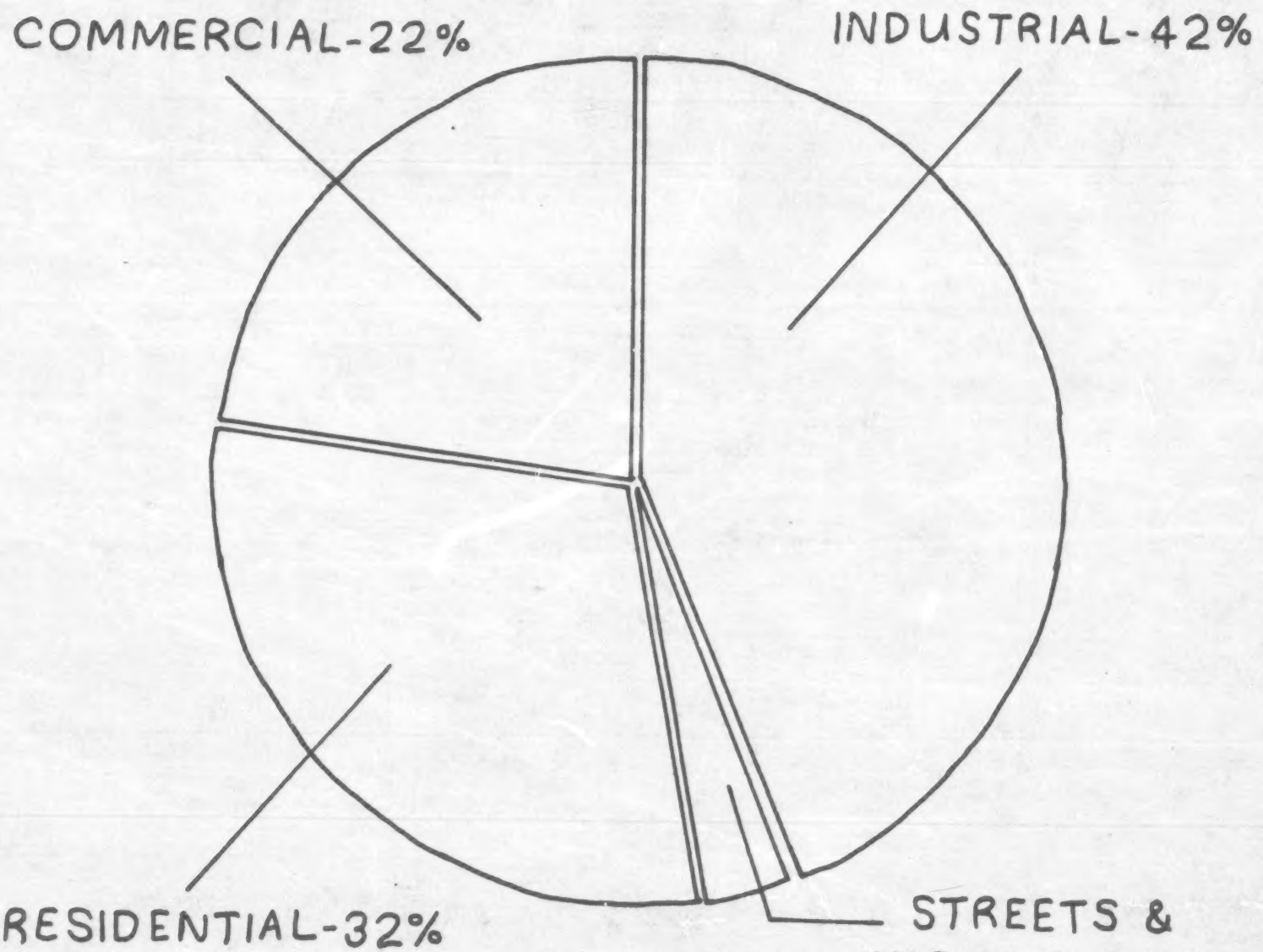
Figure A _____

Figure B _____

Subtract the number on line A from the number on line B to find the number of Kwh of electricity used.

Meter I		Meter II	
Figure B	_____	Figure B	_____
Figure A	_____	Figure A	_____
Kwh used	_____	Kwh used	_____

Electric Energy Users

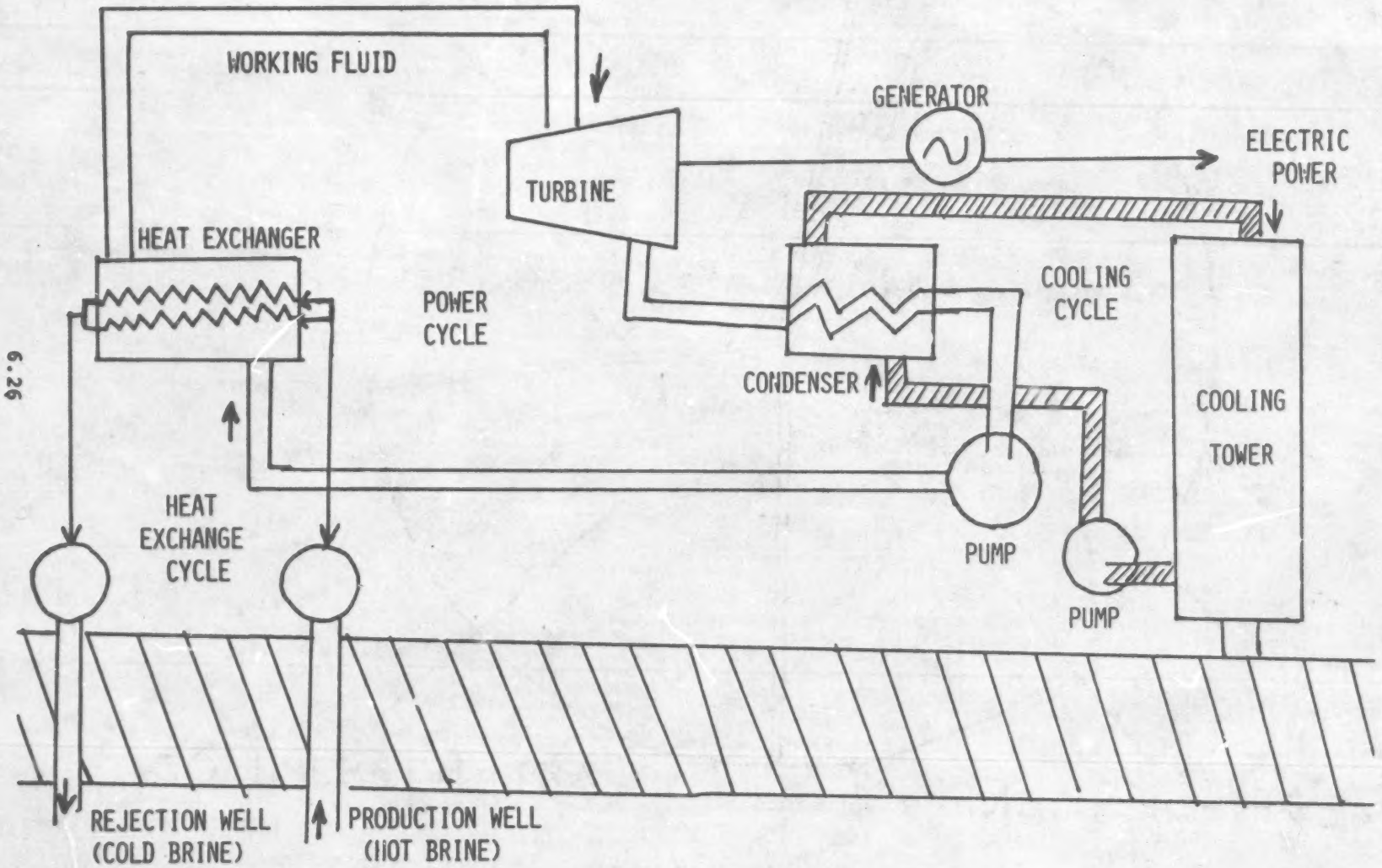


6.25

84

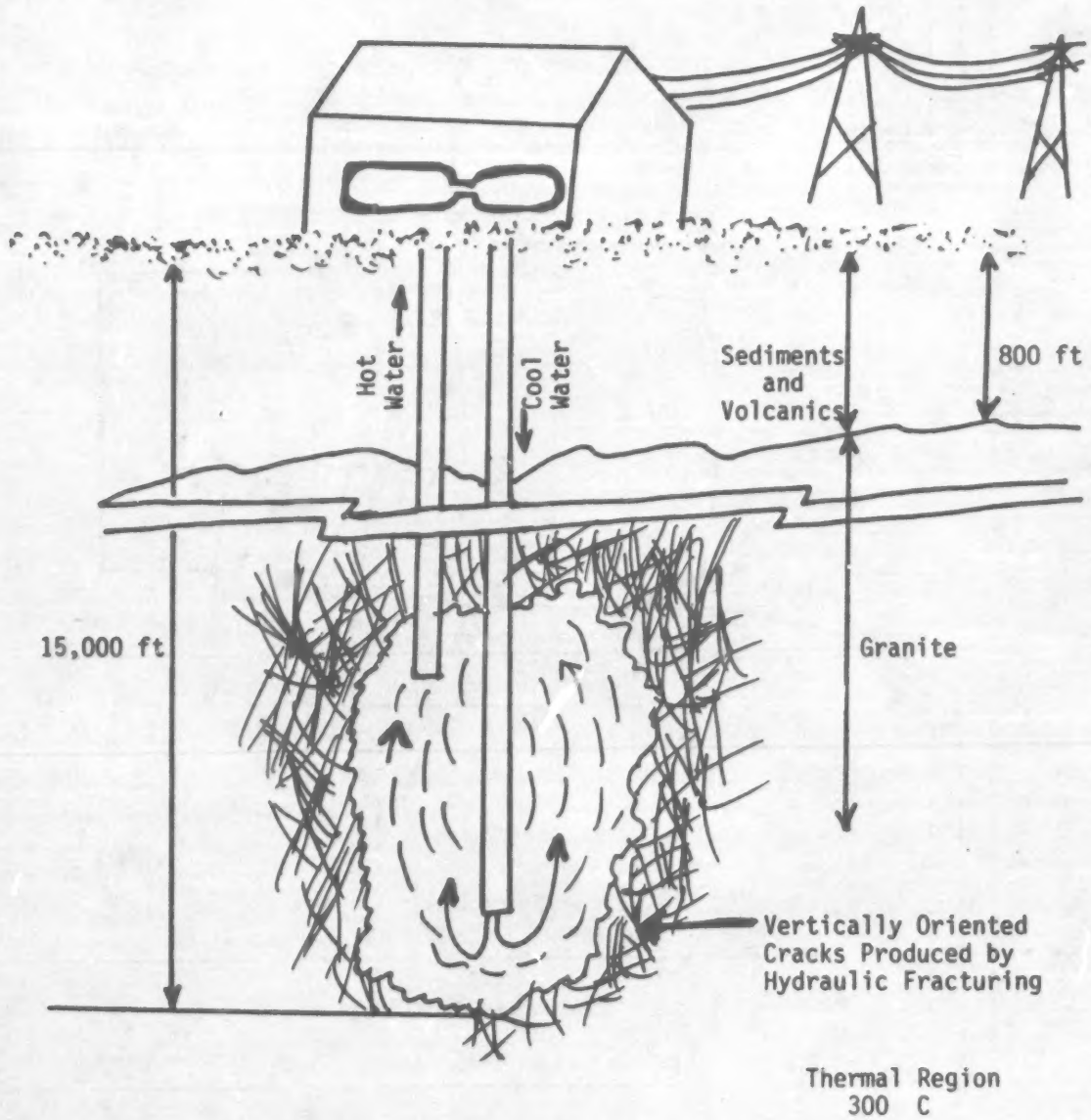
85

PROPOSED BINARY CYCLE GEOTHERMAL DOMONSTRATION PLANT (300-450°F)

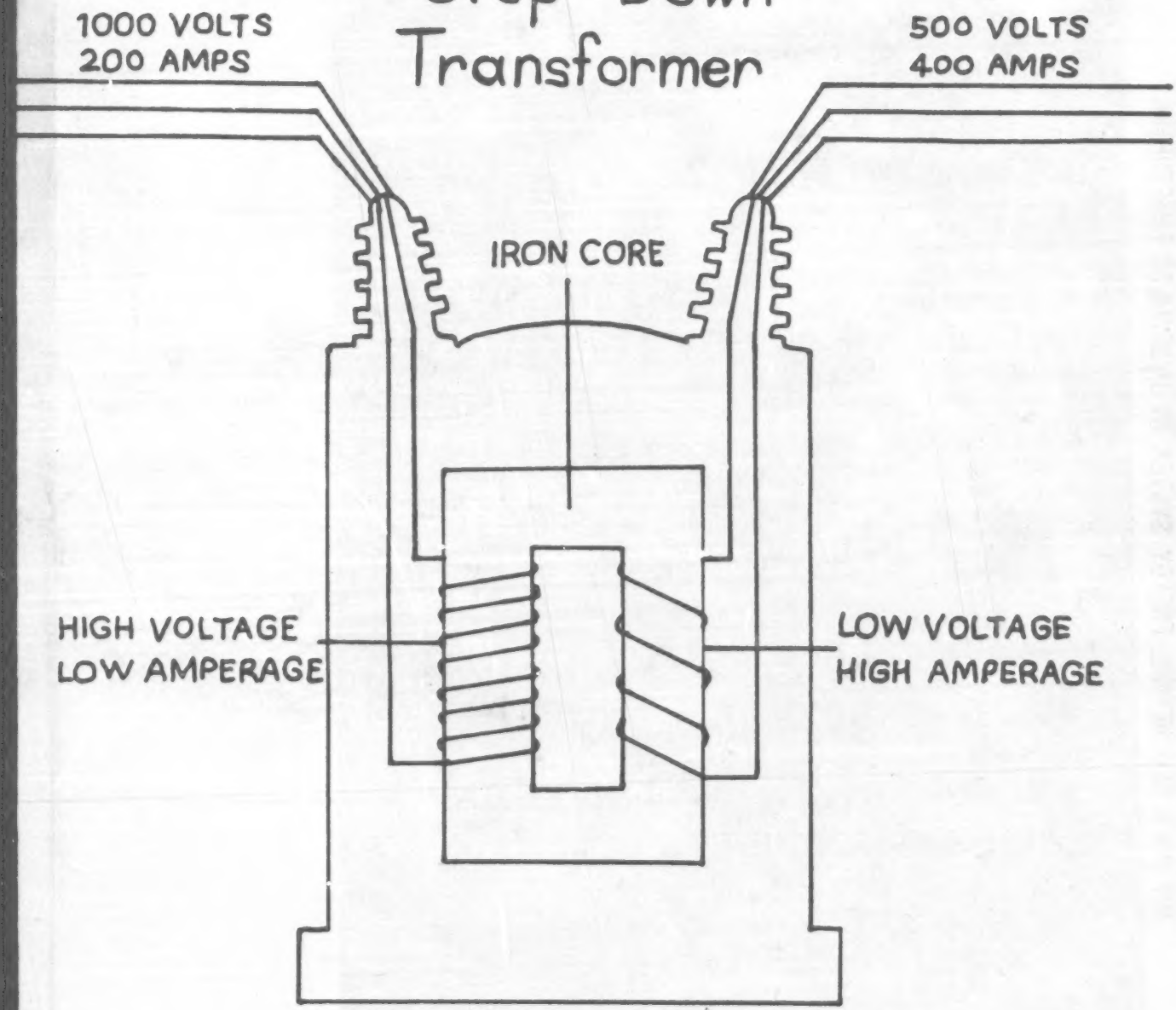


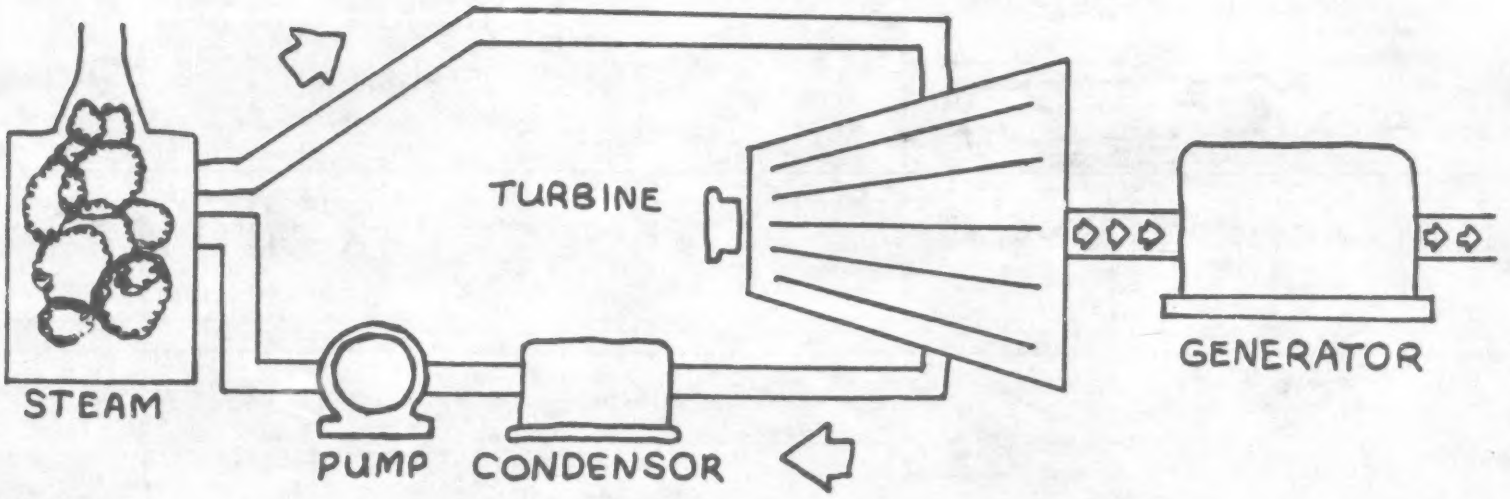
6.26

DRY ROCK GEOTHERMAL ENERGY SYSTEM BY HYDRAULIC FRACTURING



Step-Down Transformer

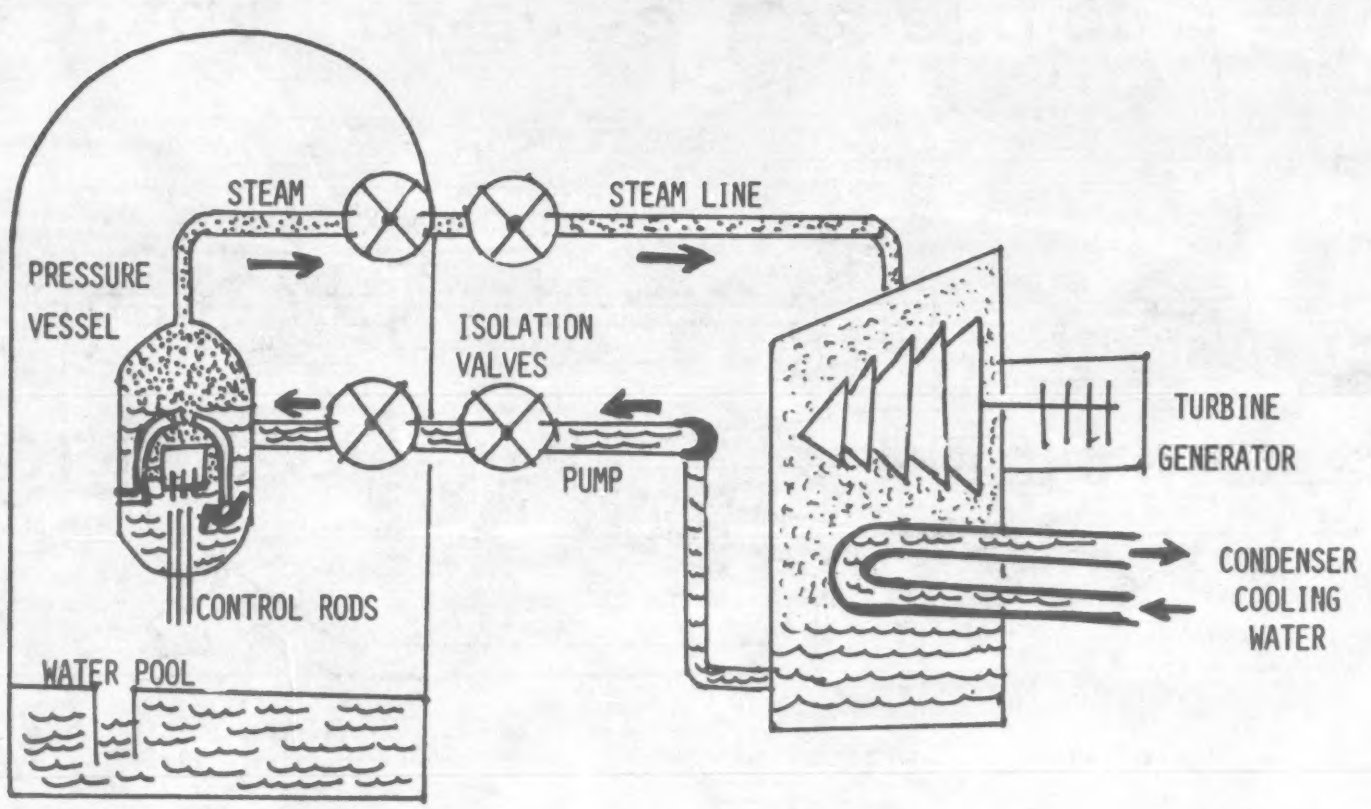




6.29

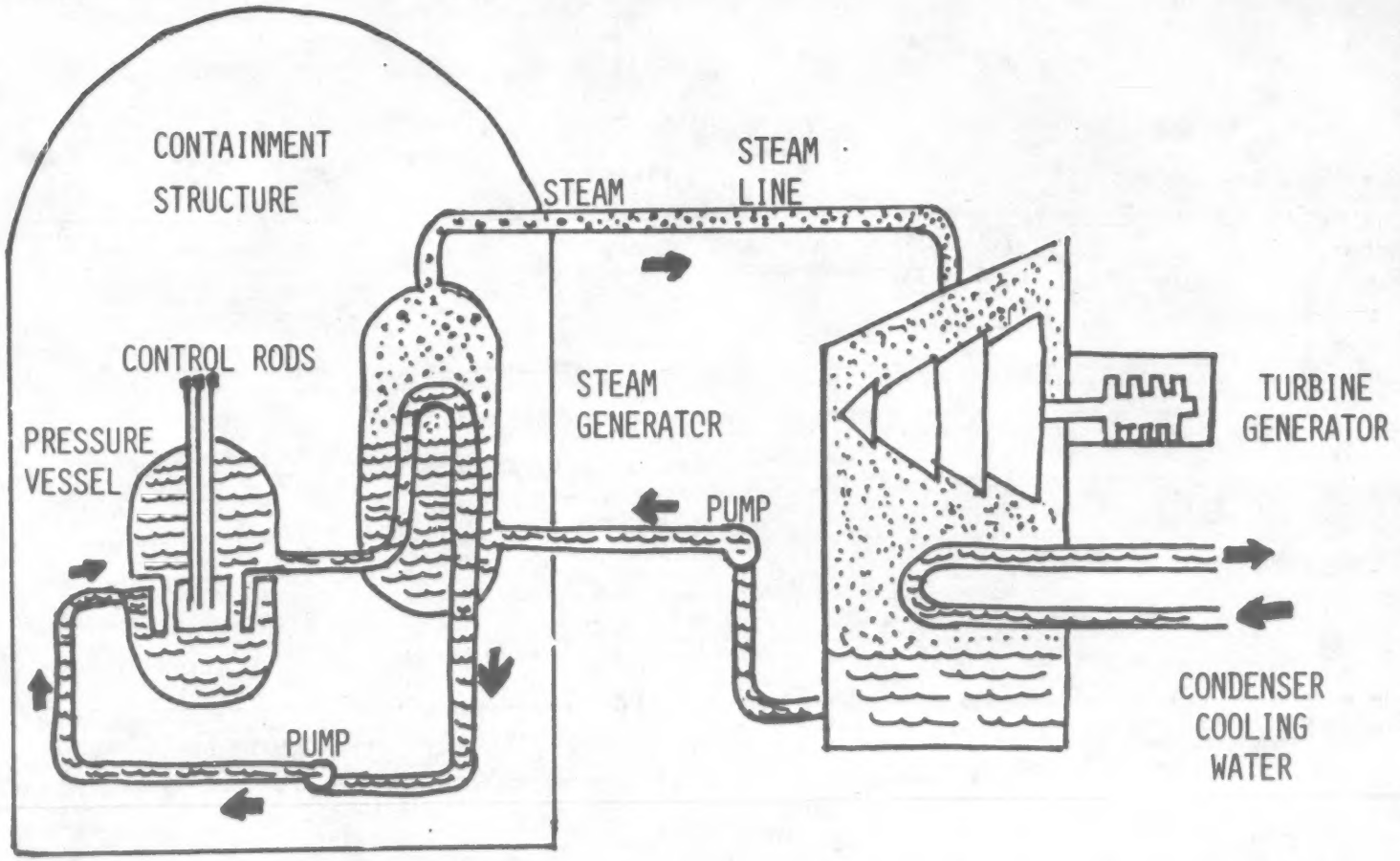
Steam Powered Generator

BOILING WATER REACTOR (BWR)



6.30

PRESSURED WATER REACTOR (PWR)



6.31

95

91

LIGHT WATER REACTOR

100 ATOMS URANIUM-235 → 60 ATOMS PLUTONIUM-239

BREEDING RATIO = .6

NO DOUBLING TIME

BREEDER REACTOR

100 ATOMS PLUTONIUM-239 → 130 ATOMS PLUTONIUM-239 → 169 ATOMS PLUTONIUM-239

BREEDING RATIO = 1.3

DOUBLING TIME-ABOUT 3 YEARS

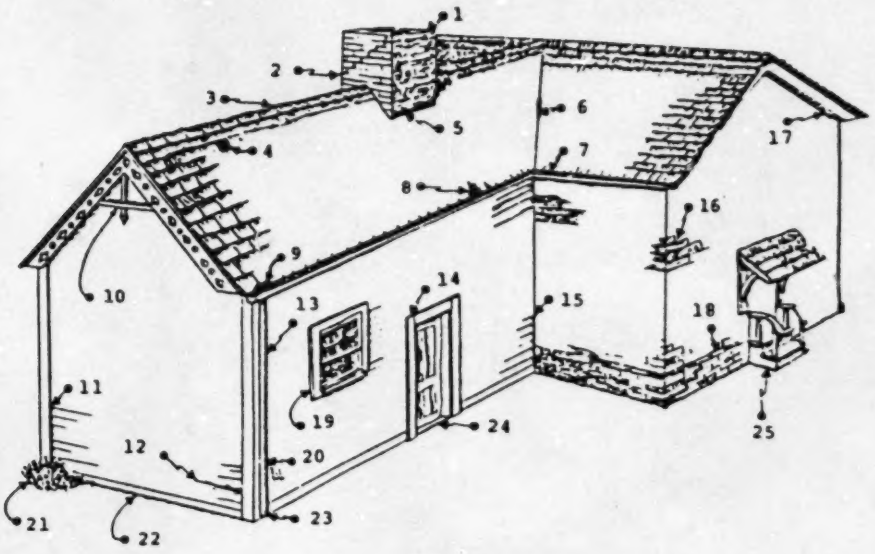
CONVENTIONAL NUCLEAR REACTORS PRESENTLY USE URANIUM-235 AS A REACTOR FUEL. BREEDER REACTORS WILL USE PLUTONIUM-239 AS A FUEL. PLUTONIUM-239 CAN ALSO BE USED AS A FUEL FOR CONVENTIONAL REACTORS.

NONFISSIONABLE URANIUM-238 MAKES UP 99.3% OF THE URANIUM CURRENTLY MINED. BY USING THE BREEDER REACTOR THE MUCH MORE COMMON URANIUM-238 CAN BE CHANGED INTO PLUTONIUM-239 AND VASTLY INCREASE OUR AVAILABLE ENERGY RESOURCES.

WHICH OF THESE

THINGS RESULT

IN ENERGY LOSSES?



1 No cap on chimney masonry.

2 Cracks in chimney brickwork.

3 Sagging timbers make ridge uneven; open joints in shingles admit water.

4 Shingles loose and missing.

5 Flashing is loose and deteriorated.

6 Flashing in valley is defective.

7 There's no flashing under shingles at edge of roof.

8 Rafter feet are decayed by water backup in clogged gutters.

9 Debris is clogging gutters.

10 Water seeps into open joints in trim and rots the wood.

11 Open joint where clapboard meets trim admits water; clapboard is rotted.

12 Cracks in siding are open invitation to more decay.

13 Undersized downspout won't carry off all water in heavy downpour.

14 Open seams in door frame admit water.

15 Open seam at joint between clapboards and brickwork.

16 Mortar is soft and crumbling; bricks are spalled and cracked. Masonry needs repointing.

17 Cracks in cornice trap wind-driven rain. Rot is developing.

18 Stress crack in brickwork from uneven settling of foundation.

19 Cracks in frame and window sill admit water.

20 Leak in downspout floods siding with water.

21 Vegetation too close to house traps water; rot is developing in siding behind it.

22 Boards at ground level have attracted termites.

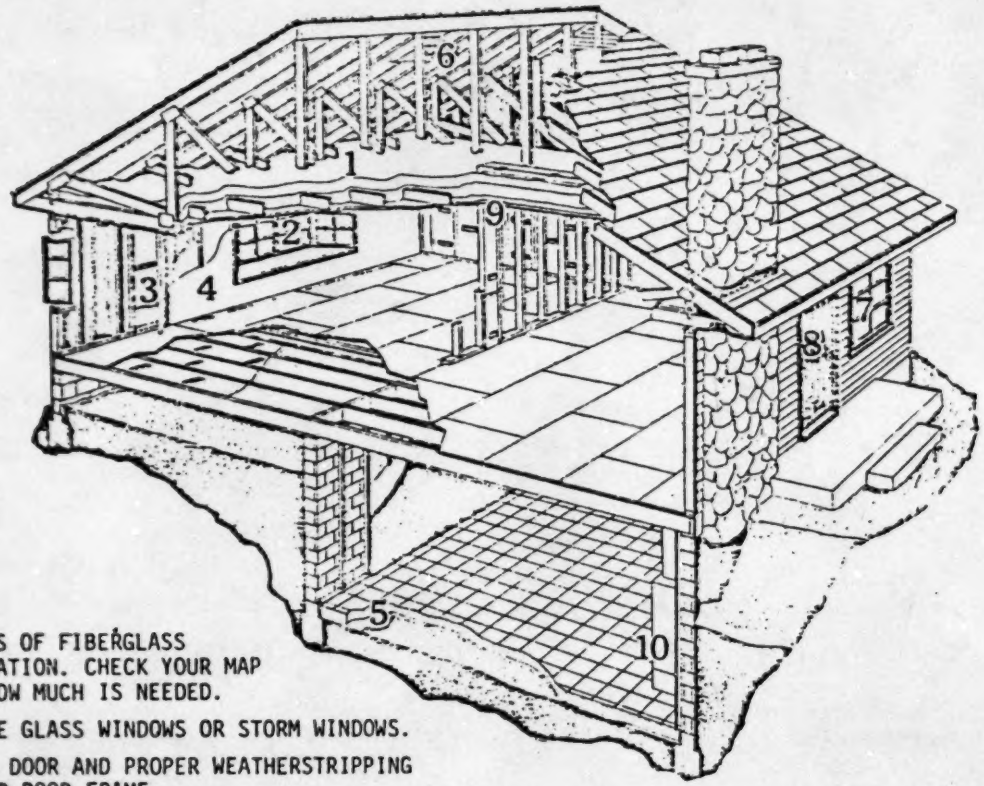
23 Rainwater is not diverted from house; water seeps through foundation into cellar.

24 Sill and floor at ground level have rotted.

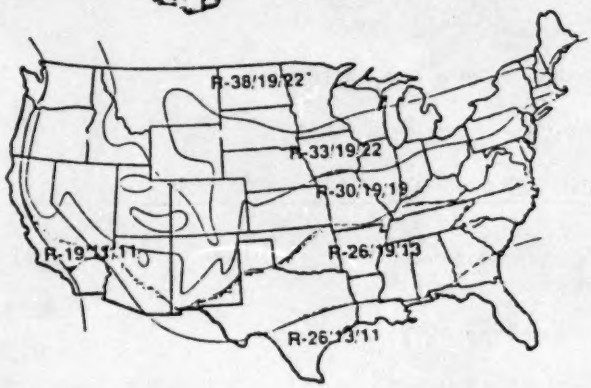
25 Wooden steps in contact with ground are infested with both rot and termites. Open joints in brackets and handrail admit water.

HOW WELL IS YOUR HOME INSULATED?

CHECK THE DRAWING BELOW AND THE LIST AT THE BOTTOM TO SEE HOW YOUR HOME MEASURES UP. YOU COULD BE WASTING LOTS OF MONEY BY TRYING TO HEAT A HOME THAT IS NOT PROPERLY INSULATED!



1. LAYERS OF FIBERGLASS INSULATION. CHECK YOUR MAP FOR HOW MUCH IS NEEDED.
2. DOUBLE GLASS WINDOWS OR STORM WINDOWS.
3. STORM DOOR AND PROPER WEATHERSTRIPPING AROUND DOOR FRAME.
4. USE OF VAPOR BARRIERS ON INTERIOR WALLS.
5. INSULATION AROUND FOUNDATION OR FOOTINGS.
6. PROPER ATTIC AIR MOVEMENT.
7. WINDOWS WEATHERSTRIPPED.
8. WEATHERSTRIPPING AROUND CHIMNEY, ALONG ROOF EDGE.
9. CERTAIN AIR AND HEAT DUCTS INSULATED.
10. PROPER SIZED HEATING AND COOLING DEVICES.



MINIMUM INSULATION FOR CEILINGS/WALLS/FLOORS

GPO 861 544